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the ACCOUNTING REVIEW

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Quarterly Journal of the
AMERICAN ACCOUNTING ASSOCIATION

MAIN ARTICLES

An Examination of the Effects of Experience and Task Complexity on Audit Judgments
Mohammad Abdolmohammadi and Arnold Wright
Performance of Auditing Procedures by Governmental Auditors: Some Preliminary Evidence
Leonard Eugene Berry, Gordon B. Harwood and Joseph L. Katz
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JANUARY 1987

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An Examination of the Effects of Experience and Task Complexity on Audit Judgments

Mohammad Abdolmohammadi and Arnold Wright

ABSTRACT: Behavioral researchers have long been concerned about the effects of experience on decision making, especially in highly technical fields such as auditing. Relying on Simon's model of the decision process, this paper provides evidence that the experience effect is significant when task complexity is explicitly considered. It reports the results of a series of experiments examining structured, semi-structured, and unstructured tasks where subjects are pooled into two groups: "experienced" (those having reached the staff level where the required normative skills are developed) and "inexperienced" (lower staff levels or auditing students). Responses to a separate study of 88 partners and managers were used to independently establish the appropriate staff level for each task and complexity. Significant decision differences were found between the experimental groups on each task. Pooling all subjects together, however, showed only an isolated significant experience effect, highlighting the need to consider explicitly and control for task complexity and appropriate normative skills in studying the nature of expertise. These results further suggest that auditing students or less experienced junior auditors are questionable surrogates for CPAs in complex audit decision settings. Future corroborating research examining other audit judgments and other audit populations is encouraged, e.g., design of audit programs.

RESEARCHERS have long been concerned about the effects of experience on decision making. For example, in highly technical fields such as auditing and accounting, knowledge of differences in the decision processes and heuristics of experts *vis-a-vis* novices would be extremely valuable in designing decision aids (e.g., decision support and expert systems) and in developing staff training programs. However, the few studies that have been conducted on the impact of experience on audit judgments report mixed results. As hypothesized by Hamilton and Wright [1982], a possible reason for this may be due to task complexity. That is, experience may be vital for complex judgments, but unimportant for routine, structured decisions. Prior studies on this issue have focused only indirectly on task complexity. The purpose of this paper is to com-

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Mohammad Abdolmohammadi is Associate Professor of Accounting, Boston University, and Arnold Wright is Harold A. Mock Professor of Accounting, Northeastern University.

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pare the judgments of subjects with varying levels of audit experience across three decision settings: structured, semi-structured, and unstructured tasks. The results suggest that task complexity is an important factor that should be considered explicitly in investigating experience effects.

The next sections of this paper contain a review of the prior research on the effects of experience in accounting and auditing, followed by an examination of the nature of task complexity. The research method employed for the experiments is then described. The last sections present the results and discuss the implications of the findings for future research.

PRIOR RESEARCH AND HYPOTHESIS

Studies on the Judgment Effects of Experience

Several studies have compared the responses of novices with those of experienced decision makers. The findings are mixed. For example, Human Information Processing research has consistently shown a strong similarity between novices and their "real-world" counterparts in information processing capabilities and biases [Slovic et al., 1977].

A number of recent auditing studies have examined the nature of the knowledge base and memory retrieval processes of experienced practitioners versus novices and report distinct differences. Weber [1980] conducted a free recall experiment from a list of computer controls read aloud. Experienced EDP auditors showed a significantly higher degree of *cue clusters* than novice students, suggesting a grouping in memory of controls along categories such as input controls and output controls. Auditors also recalled a substantially larger number of controls than novices.

Frederick and Libby [1986] investigated likelihood assessments of account errors given descriptions of internal control weaknesses. Such assessments are dependent upon one's knowledge base of the relationship between controls and the incidence of errors. Experienced auditors were found to frequently commit double and single fallacies of conjunction, while novices displayed a common pattern across different control scenarios. These results suggest that experts store patterns (schema) of likely control-error scenarios in memory from experience, which novices do not possess. Libby [1985] also found the presence of schema by experienced auditors in identifying likely errors present from analytical review fluctuations. Errors identified were those that were perceived to (and that do) occur most frequently in practice, demonstrating the existence of a knowledge base from experience.

Student Surrogation Studies

Given the complexity of audit decisions, researchers have questioned the appropriateness of employing students or less experienced staff in examining audit judgments. However, the numerous advantages of surrogation, such as greater availability and lower costs, provide the motivation for carefully considering the appropriateness of relying on these subjects.

Studies in accounting by Dyckman [1966], Mock [1969], and Hofstedt [1972] have discovered strong correspondence between student decisions and practicing experts. However, there has also been evidence in several accounting/business studies that students are poor surrogates. Alpert [1967] and Copeland, Francia, and Strawser [1973] reported significant differences in opinion change and attitudes, respectively, of students and actual decision-makers. Abdel-khalik

[1974] compared the loan decisions of MBA students and loan officers and concluded that students provided unreliable measures of bankers' performance. In reviewing the research on the appropriateness of student surrogates, Dickhaut, Livingstone, and Watson [1972] state that there do not appear to be predictable conditions for establishing the adequacy of students.

There has been limited surrogation research in auditing. Ashton and Kramer [1980] compared the internal control judgments of students and auditors for a payroll system and found numerous significant differences. They, however, conclude that the general decision cues relied upon and the cue utilization patterns were similar. Hamilton and Wright [1982] essentially employed the same internal control task as Ashton and Kramer and arrived at a similar conclusion; no significant correlation could be found between experience and consensus, cue weighting, self-insight, or consistency. These two studies suggest that students may be reasonably good surrogates for experienced auditors.

Contradictory results are reported by Krogstad et al. [1984] in examining materiality assessments for a proposed adjustment to the allowance for bad debts of a hypothetical company. Auditors displayed greater consensus, consistency, and self-insight than students. Students focused on a greater number of cues, placed more reliance on contextual cues, and displayed a greater incidence of significant interactive effects, thereby suggesting configural information processing as compared to the linear models apparently employed by practitioners. Therefore, the findings of Krogstad et al. [1984] suggest that students are poor surrogates for the materiality judgments considered.

Krogstad et al. [1984] compare their inconsistent results to the Ashton and Kramer [1980] and Hamilton and Wright [1982] studies and posit that the reason for the conflicting findings may be due to the level of task structure and complexity present. Internal control judgments are relatively more structured than other audit decisions, i.e., in college and in practice the importance of "separation of duties" is stressed as the major factor (cue) in evaluating internal control, whereas materiality decisions are largely unstructured. Thus, the suitability of students or less experienced audit staff may vary substantially in other audit decision contexts. As Hamilton and Wright [1982] note:

> our experiment used a fairly simple and well-structured decision setting. Perhaps experience plays a much more significant role in less-structured decision contexts, which is an issue for future research [p. 765].

Task Structure and Complexity

It is widely acknowledged that individuals face tasks (decision settings) that vary considerably in complexity. Simon [1960] categorizes judgments along a continuum from "programmed" (repetitive, structured tasks) to "non-programmed" (novel, unstructured) and proposes a model that divides the decision-making process into three phases:

a. Intelligence—gathering information to understand the problem, the risks involved, and key factors to consider;
b. Design—identifying the alternative courses of action; and
c. Choice—arriving at a decision as to the best alternative to take.

Simon stresses that these phases generally follow the sequence above (a through c), but the process is iterative and each

FIGURE 1

TASK COMPLEXITY AND THE DECISION PROCESS

	Decision Process		
Task Complexity	*Intelligence*	*Design*	*Choice*
Unstructured	Unique, undefined problem, few or no guidelines available	Infinite/undefined alternatives	Judgment & insights needed
Semi-structured	Repetitive, reasonably defined problem; guidelines available	Limited; specified alternatives	Judgment needed
Structured	Routine, well-defined problem & cues	Limited/well-specified alternatives	Little judgment needed

phase entails a complex judgment process in itself.

Gorry and Scott-Morton [1971] and Keen and Scott-Morton [1978] use Simon's [1960] model to examine the relationship between task structure and each of the decision phases, as shown in Figure 1. In a structured setting, the problem and important variables are specified, whereas an unstructured task requires the judgment and insights of the decision maker to define the problem. The intelligence phase for a semi-structured task falls in the middle of the continuum (routine, well-defined problem to unique, undefined problem), where the problem is reasonably clear but the key factors are not. However, some guidelines or criteria are available to define the critical variables to consider.

In the design phase, structured and semi-structured tasks entail a limited number of alternatives that are well-specified or reasonably well-specified. Unstructured tasks lead to a greater number of undefined alternatives, requiring that the decision-maker identify the pertinent choices at hand. Finally, the level of judgment and insights needed to arrive at a decision would vary significantly from the structured task, where little or no judgment is necessary, to the unstructured task, where a very high level of judgment is essential. Some structured tasks may be automated, such as the EOQ decision in inventory management, where little human intervention is necessary.

Simon's model thus suggests that the effects of experience will increase as the task becomes increasingly complex. In auditing, this relationship would appear to explain the conflicting results of prior studies. For example, no experience effects were found for the relatively structured task of evaluating the internal controls of a simplified payroll system in the studies by Ashton and Kramer [1980] and Hamilton and Wright [1982], yet substantial effects were reported by Krogstad et al. [1984] for less structured materiality judgments. Additionally, significant experience effects are demonstrated in studies by Frederick and Libby [1986] and Libby [1985] in examining other complex decision settings (relationships between internal control weaknesses and accounting errors, and analytical review, respectively).

Research Hypothesis

Based upon the above literature

review, one would anticipate that an auditor would benefit from experience as the complexity of an audit decision increases. More complex tasks require extensive judgment and insights in all phases of the decision process, which can be gained through experience. Therefore, the central hypothesis of this study is:

> Experience effects in auditing are positively related to the level of task complexity.

This hypothesis is drawn from Simon's model of task complexity discussed above. Thus, the effects of audit experience are posited to be increasingly significant as the complexity of the audit decision grows. This study attempts to compare the decisions of experienced and inexperienced auditors across tasks of varying complexity.

Because auditing is a "profession" whose principal functions rest largely on the judgments of trained experts, few audit decisions are totally structured and few can be fully automated. However, audit tasks appear to differ considerably in the *relative* complexity and structure involved. Referring to Figure 1, for example, the task of internal control evaluation appears to be a structured or semistructured task [Ashton and Kramer, 1980; Hamilton and Wright, 1982] that normally entails a well-defined, routine problem at the intelligence phase of the decision process. Internal control evaluations often involve the completion of standardized internal control questionnaires with well-specified factors to look for (e.g., separation of duties). This task also offers limited/well-specified alternatives at the design phase (e.g., strong, mediocre, weak controls), leaving limited judgment to the decision maker at the choice phase. However, the relative position of a given audit task along the complexity continuum is subject to question. Thus, independent verification was sought to classify the experimental tasks on the complexity dimensions (structured, semistructured, unstructured) and relevant experience level. This is explained in the Research Method section.

RESEARCH METHOD

Three cases taken from actual audit engagements were used in a series of laboratory experiments to study the effects of experience and task complexity on audit decisions. The three cases covered six audit tasks. These tasks were classified as structured, semi-structured, and unstructured, based on a survey of a group of highly experienced auditors from six national CPA firms. This section provides details of the research method used.

Task Complexity Verification

To obtain verification of the complexity dimensions of experimental tasks (see below), a survey questionnaire was sent to 105 managers and partners from six national CPA firms. The questionnaire provided the subjects with a simple definition of Simon's model of task complexity, along with some examples. The subjects were then requested to evaluate an experimental audit task (see below) along two dimensions: (1) complexity (on a continuous scale from structured to unstructured); and (2) the staff level at which each task is normally completed; i.e., the level when an auditor has the normative experience and knowledge to make the judgment required. Very experienced subjects were sought, because of (1) their familiarity with the various tasks and (2) their knowledge of the staff level required to accomplish each task. Eighty-four percent (88 participants) of our original sample responded. This sample reflects the desired profile described above. The average participant's level of audit experience was

TABLE 1
EVALUATIONS OF TASK COMPLEXITY

Task	Audit Task Complexity			Appropriate Staff Level		
	*Mean**	*SD*	*Median*	*Mean**	*SD*	*Median*
Unstructured						
Subject-to opinion for uncertainty on a land write-down.	19.72	6.18	22.0	4.81	.40	5.0
Treatment of a debatable audit adjustment (footnote disclosure vs. requiring adjustment).	19.16	4.49	26.0	4.31	.61	4.0
Semi-structured						
Evaluating internal controls for a sales and collection cycle.	11.84	4.07	11.0	2.25	.61	2.0
Determining the maximum tolerable error rate for compliance tests.	11.14	5.94	10.5	2.65	.97	2.5
Judging expected population error rate in compliance testing.	10.90	4.62	11.0	2.55	.76	2.0
Structured						
Selecting a compliance sample size for a sales and collection cycle.	7.90	4.47	8.0	2.02	.73	2.0

* Responses were on a continuous scale, divided into nine equal intervals for measurement purposes. For greater accuracy each interval was further divided into three sections. Subject evaluations were measured with a ruler and car range from 0–27 (structured–unstructured).

SD=standard deviation

Staff levels were coded as follows:
1 Junior
2 Senior
3 Supervisor
4 Manager
5 Partner

12.08 years; 40 subjects (44 percent) were partners and 48 managers (56 percent).

Table 1 presents the results of the task evaluations. The tasks were chosen to reflect common audit judgments that appeared to vary considerably in complexity and were the decision contexts examined in the experiments to be described in the next section. As the mean responses indicate, the tasks appear to fall into the following categories of the model employed:

- unstructured
    - —subject-to opinion decision on a land write-down
    - —disclosure of a debatable audit adjustment
- semi-structured
    - —internal control evaluation
    - —maximum tolerable error rate judgment
    - —expected error rate judgment
- structured
    - —compliance sample size decision

The above classification is based on the following statistical tests; first, the overall results of an ANOVA ($F=58.50$; $p=.0001$) indicate that the audit tasks studied represent a wide range of com-

TABLE 2
EXPERIMENTAL DESIGN

Task Structure	*Task*	*Case*	*Students*	*Auditors*	
				Numbers	*Mean Years of Experience*
Unstructured	Appropriateness of qualified opinion	McAllister Company	96	63(a)	10.50
	Adjustment requirement	McAllister & Winslow Companies	96	63(a)	10.50
Semi-structured	Internal control evaluation	Fast Freight Company	50	65(b)	3.57
	Expected, and tolerable error rate judgments	Fast Freight Company	50	65(b)	3.57
Structured	Selecting a compliance test sample size	Fast Freight Company	50	65(b)	3.57

(a) and (b): The auditors in these experiments had the following ranks:

Experiment	*Auditor Rank*					*Total*
	Junior	*Senior*	*Supervisor*	*Manager*	*Partner*	
(a)	0	5	17	11	30	63
(b)	5	36	16	4	1	65

plexity, as judged by experienced auditors. Second, a series of Scheffé and Tukey pairwise comparison tests corroborated the classification with significant differences ($P \leq .05$) found between the structured decision and all others and the semi-structured tasks and others.

The staff level data in Table 1 parallel the task complexity results. That is, while the structured and semi-structured judgments were perceived to be accomplished proficiently by seniors or supervisors, the unstructured tasks were judged to be done by managers or partners.

The Experiments

Experiments took place in a laboratory environment. These experiments were conducted at the offices of the participating firms, training programs, or professional meetings. Student-subjects participated in a classroom environment at the institutions where the authors were teaching. Table 2 presents the experimental design.

In the unstructured task category, 96 students[1] and 63 practicing auditors (mean audit experience of 10.5 years) were asked to determine the appropriate disclosure for a proposed audit adjustment on two cases ("McAllister, Inc." and "Winslow Company") taken from

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[1] Students had completed at least two-thirds of an auditing course at the time the experiment was administered.

FIGURE 2
EXPERIENCE CLASSIFICATION OF SUBJECTS

	Inexperienced	*Experienced*
Unstructured tasks	Students and junior-supervisors ($n=111$)	Managers and partners ($n=41$)
Semi-structured tasks	Students and junior auditors ($n=58$)	Senior auditor or higher ($n=57$)
Structured task	Students and junior auditors ($n=58$)	Senior auditor or higher ($n=57$)

the Trueblood Seminar sessions. Subjects were instructed to determine whether:

1. an adjustment was required, and
2. a qualified opinion was appropriate (McAllister, Inc. case only).

Participants decided whether an adjustment was called for on a one to seven (yes-no) scale, but they were not required to decide on the details and magnitude of the adjustment needed. Finally, subjects had to decide whether or not a qualified opinion was appropriate on a one to seven (yes-no) scale, but they were not required to specify the wording of the qualification.

Fifty undergraduate auditing students[2] and 65 practicing auditors (mean audit experience of 3.57 years) participated in the structured and semi-structured audit experiments. All participants were provided with detailed descriptions of a system of internal controls at a freight company (Fast Freight, Inc.) taken from Neter and Loebbecke [1975] and Romney [1977]. Subjects were instructed to complete two tasks: First, evaluate the system of internal controls as either very strong, strong, mediocre, weak, or very weak (i.e., one to five scale). As discussed earlier, this task was considered a semi-structured judgment. Second, participants were also instructed to make judgments regarding: (1) the expected population (compliance) error rate; (2) maximum tolerable error rate; and (3) the resulting sample size requirement (for a 95 percent confidence level). As noted before, the first two decisions are considered semi-structured tasks and involve expression of a point estimate of an error. The third decision is structured because it simply involves arriving at an appropriate sample size from a standard statistical table.

RESULTS

For statistical analyses of the data, subjects on each audit judgment were grouped into two categories: "inexperienced" and "experienced." The first group includes all participants (students and auditors) who had not yet reached the experience level considered necessary to have the expertise to complete the task, as determined by the findings of the task evaluation study reported in Table 1. The latter group encompasses all subjects possessing audit experience equal to or exceeding the desired level.[3] Figure 2 summarizes this classification.

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[2] Subjects were enrolled in one of the two sections of an auditing course. They had completed three-fourths of the course and had been taught internal control evaluation and statistical sampling in auditing in detail.

[3] "Inexperienced" does not necessarily imply a subject has no audit experience, since this group includes individ-

TABLE 3
UNSTRUCTURED TASKS

	Experimental Groups					
	Experienced (*n*=41)		Inexperienced (*n*=111)			
Audit Decision	*Mean*	*SD*	*Mean*	*SD*	*T-statistic*	*Significance*
McAllister, Inc.:						
Audit Adjustment	4.41	1.92	3.53	2.06	2.39	0.018
Qualified Opinion	5.43	1.73	4.41	1.99	2.93	0.004
Winslow Co.:						
Audit Adjustment	3.57	1.90	2.83	1.70	2.33	0.021

Response scale 1-7 (yes-no)
SD=Standard deviation

Since subjects are grouped by experience level necessary for each audit judgment, we would expect to find significant experience effects in decisions between the groups on each of the tasks as reported in this section.

Unstructured Tasks

Significant judgment differences were found in the unstructured tasks as reported in Table 3. The experienced partners and managers were less likely to require an audit adjustment or a qualified opinion than other subjects. The experienced group was especially opposed to a qualified opinion, whereas less experienced participants were somewhat neutral on this decision. Perhaps this finding reflects the knowledge by partners and managers of the severity of such an opinion and its potential financial impact on the client. The "subject-to" opinion has recently come under heavy criticism by the Auditing Standards Board, who originally favored eliminating this type of opinion. Strong reactions by users eventually led the Board to choose reluctantly instead to clarify the nature of the "subject-to" opinion and when it is appropriate.[4]

As Table 1 indicates, the mean response on the appropriate staff level at which a "subject-to" opinion decision is made was very close to partner (the mode was partner). To test the sensitivity of the results, subjects were pooled into two groups comparing "subject-to" judgments, with the following findings:

	Partners (*n*=30)	*Below Partner* (*n*=119)
Mean response	5.87	4.39
Standard deviation	1.34	1.99
T-statistic	3.92	
Significance	.0001	

TABLE 4
SEMI-STRUCTURED TASKS

Internal Control Evaluation:

Groups	*Very Strong*	*Strong*	*Mediocre*	*Weak*	*Total*
Experienced	16(28%)	40(70%)	1(2%)	0(0%)	57(100%)
Inexperienced	16(28%)	34(59%)	5(8%)	3(5%)	58(100%)

Chi-square = 6.148 Significance = .10

Expected Population Error Rate (EPER) and Maximum Tolerable Error Rate (MTER) Judgments:

	EPER (%)		*MTER (%)*	
Groups	*Mean*	*SD*	*Mean*	*SD*
Experienced ($n=57$)	2.52	1.29	5.40	1.96
Inexperienced ($n=58$)	4.03	1.36	6.56	1.65
T-statistic	6.09		3.41	
Significance	.0001		.0009	

SD = Standard deviation

These results again corroborate the experience effects of this unstructured, complex audit decision.

Semi-Structured Tasks

Table 4 reports on the semi-structured task results. As presented in the top panel of Table 4, the task of internal control evaluation resulted in a .10 level of significance in differences between experienced and inexperienced auditors (chi-square = 6.148). A majority of subjects (98 percent experienced and 87 percent inexperienced) rated the system of internal controls to be strong or very strong. As advanced by Ashton and Kramer [1980] and Hamilton and Wright [1982], these subjects might have utilized the same cues (although they may have used different weights for the cues utilized) for this purpose. For example, both experienced and inexperienced subjects may have viewed separation of duties and authorization of transactions to be important internal control features in the case-study system. Some 13 percent of inexperienced subjects, however, rated the system as mediocre or weak against only two percent in the experienced group. The chi-square test used was most likely significantly affected by this difference ($p=.10$).

Significant differences are also found for the semi-structured tasks of expected population error rate (EPER) and maxi-

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uals (both students and auditors) who have been employed in public accounting (e.g., juniors, seniors). Rather, this designation relates to the specific audit task examined, i.e., "inexperienced" subjects are expected to have little or no background in actually performing the task in question.

[4] See Loebbecke [1986] for an update and discussion.

TABLE 5
CORRELATION BETWEEN AUDIT DECISIONS AND LEVEL OF EXPERIENCE

Decision	*Spearman Correlation Coefficient*	*Significance*
Unstructured Tasks		
Adjustment Requirement		
McAllister Company	0.1628	0.115
Winslow Company	0.1346	0.159
Qualified Opinion		
McAllister Company	0.1413	0.149
Semi-structured Tasks		
Internal Control Evaluation	−0.0813	0.262
EPER Judgment	0.0452	0.360
MTER Judgment	0.2365	0.029*
Structured Task		
Sample Size Decision	−0.1047	0.203

* Significant at the .05 level.

mum tolerable error (MTER) judgments as reported in the lower panel of Table 4: experienced subjects assessed significantly smaller EPERs (*t*-statistic = 3.41, significance = .0009) than inexperienced subjects. The implication of these differences for the resulting sample sizes is discussed in the next subsection.

Structured Task

Our structured task was a sample size decision requiring statistical tables. Having assessed their EPERs and MTERs, all subjects used a 95 percent confidence sample size table to determine the required sample sizes. Thus, the sample size decision was dependent upon the EPER and MTER judgments. Given the significant experience effects reported in the previous subsection on EPER and MTER judgments, one would expect significant differences in the resulting sample sizes. In fact, the resulting sample sizes of the experienced subjects (mean = 213.57) were significantly (*t*-statistic = 3.77, significance = .0003) smaller than those of the inexperienced subjects (mean = 376.98).

Thus, our structured task was not an independent task. It is reasonable to posit, however, that given the same EPER, MTER, and confidence level, experienced and inexperienced subjects would choose the same sample size from a given table, indicating no experience effect.

All Tasks Taken Together

This study argues that in investigating the role of expertise in auditing, it is important to identify first the normative audit skills needed to arrive at various judgments and the staff level at which these skills are acquired. It was suggested that the conflicting results of prior studies on this issue may have occurred because of failure to control for these factors. To explore further this possibility, all auditors were grouped together and a Spearman correlation was used to study the relationship between auditors' practical experience (measured in number of months of accounting and/or auditing practice) and judgments made (measured in scales described in the Research Method section). Table 5 presents the results. As indicated, contrary to the earlier findings in Tables 3 and 4 where task complexity and normative skills are explicitly considered, virtually no significant experience effects are found here. The curious findings in Table 5 mirror the results of some prior studies where, contrary to expectations, few or no experience effects are indicated for selected audit tasks. As suggested in Table 5, the problem in these cases may be because "expertise" is not properly defined to reflect task complexity and auditor skills/knowledge base.

SUMMARY AND CONCLUSIONS

The results support the central hypothesis in that significant decision differences were consistently found between experienced staff and other subjects for unstructured and semi-structured tasks. The structured task of sample size determination from given statistical tables also showed a significant experience effect. However, it was argued that this effect is attributed to the experience effect of the semi-structured tasks of EPER and MTER judgments. Subjects used their EPERs and MTERs to determine sample sizes suggested by a 95 percent confidence level statistical table. Future corroborating research should include independent structured tasks to study the effect of experience.

The significant experience effects found for unstructured and semi-structured tasks suggest that accounting students or less experienced staff are dubious surrogates in such audit decision settings. This implies that past studies employing such surrogates must be interpreted with caution and reservation. Additionally, future researchers should be aware of the apparent significant loss in external validity when using such surrogates in auditing research.

It is important to note that the judgment differences found could be due to any one (or a combination) of intelligence, design, and choice phases of the decision process. The data collected in the present study do not allow any conclusion as to which of these factors caused the judgment differences. Future research is needed on differences in the decision process (intelligence-design-choice phases) of experts versus novices. The objective would be to incorporate the expertise of experienced auditors in staff training and/or decision aids for use in practice.

In interpreting and generalizing the findings here, the samples and tasks employed must be considered. Future corroborating studies can expand the tasks and auditor experience samples. In this way, the hypothesized task complexity and normative skill effects advanced here may be further supported. What does, however, seem clear from the findings is that the nature and effects of experience appear to be complex phenomena that we are only at the embryonic stages of understanding.

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Performance of Auditing Procedures by Governmental Auditors: Some Preliminary Evidence

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ABSTRACT: The evaluation of the quality of governmental auditors' work is of keen interest among governmental audit policy-makers. However, as there is little published evidence on which to base such evaluations at this time, this paper discusses the results of an exploratory study on the subject. The study assumes that the extent to which an auditor actually performs the audit procedures prescribed by a given audit program is an important indicator of the quality of the auditor's work. Accordingly, responses were sought from governmental auditors at all levels of government as to their failure to perform prescribed procedures, even though they affirmed performance through sign-offs on their working papers. To offer anonymity to the respondents and to encourage truthful responses, the survey was based on the randomized response technique. The findings indicate that a number of false sign-offs have occurred among governmental auditors as a group. Within the governmental group, the study found that false sign-off rates were slightly higher among auditors at the state level than those at the federal level. Also, rates were slightly higher among auditors not working under a civil service system than those who were, and higher among those who were not certified compared to those who were. It also found that independence of the audit function was not helpful in explaining positive false sign-off rates. However, the significance of these differences as a way of describing the false sign-off rates of governmental auditors was not strong.

THE requirement that the performance of governmental auditing procedures be reviewed to determine whether they have been performed satisfactorily is inherent in the professional auditing standards of the United States General Accounting Office [GAO, 1981]. In most audit organizations this requirement is usually incorporated into a quality control program. In the public accounting profession and private enterprise internal auditing, an important dimension of quality control has been the regular practice of quality-assurance reviews (also called peer

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reviews), which assess the quality of audit work of the audit organization as a whole [Pearce and Thornhill, 1985].

During the past five years federal government officials have become convinced of the need to evaluate the quality of governmental audit work as well. For example, the Office of Management and Budget (OMB) issued Circular A-102 in 1979 requiring a single, organization-wide audit of each governmental unit receiving a grant from the federal government in lieu of an audit of the grant alone. The Circular also required that a quality-assurance review be performed on the audit work. The requirements of the OMB Circular have now been enacted into law by the U.S. Congress in the Single Audit Act of 1984.

In prior research related to quality-assessment reviews in governmental auditing, Ferber [1976] discussed a GAO investigation of the internal audit function within the U.S. Department of Transportation. Berry [1978] presented evidence on the nature of the quantitative criteria that selected experts in governmental auditing considered important in evaluating a governmental audit organization. Garner [1980] offered evidence that the low level of funding provided to various federal audit organizations in relation to higher levels of funding provided to many auditee organizations may lead to low audit quality in the federal sector.

An interview with U.S. General Accounting officials by the authors revealed that they have recently commenced quality-assurance reviews of 20 major audit agencies at the federal level. Also, within the last three years the National Intergovernmental Audit Forum has attempted to establish a voluntary, national quality-assurance program at the state and local levels, although no research findings appear in the literature on the extent to which this program has been implemented.

The preceding discussion suggests that there is little research in the literature on the performance of auditing procedures by governmental auditors and the use of quality-assurance reviews for control of audit work. The purpose of this study is to explore (1) whether governmental auditors have failed to perform required auditing procedures and then concealed this omission (hereafter referred to as false sign-offs), (2) the extent to which these false sign-offs exist, and (3) differences in the extent of false sign-offs across certain characteristics of governmental auditors and their environment.

A THEORETICAL DEVELOPMENT OF THE ISSUES RESEARCHED

The following discussion outlines some characteristics of governmental auditors and their environment that may explain false sign-off rates.

Governmental Auditors Compared to Private Enterprise Auditors

Previous research has shown that false sign-off rates existed among private enterprise auditors. Rhode [1977, p. 179] found that a large proportion of his participants (all CPAs and 74 percent in public accounting) indicated that they sometimes engaged in false sign-offs. Time pressures and client-imposed deadlines were the main reasons given for the false sign-offs. Buchman and Tracy [1982] compared the effectiveness of different questionnaire designs in eliciting sensitive responses from auditors who were CPAs engaged in public accounting practice. In the process they also found evidence of false sign-offs. Alderman and Deitrick [1982] found evidence of false sign-offs among public accountants due to time budget pressures and Buchman [1983], studying the reliability of internal auditors' working papers, found some evidence of false sign-offs within that group as well.

These prior studies on false sign-offs cannot be directly extrapolated to governmental auditors, as they either expressly excluded governmental auditors or only included them in an incidental way. Furthermore, notable differences exist between the scope and environment of governmental auditing and the scope and environment of private enterprise auditing. Zimmerman [1977] modeled governmental officials as agents of citizens of their governmental entity and posited that these officials will tend to shirk or use their office for political gain, i.e., to be re-elected or reappointed. In turn, citizens and other interested parties (creditors, public interest groups, the media, etc.) will create or cause the creation of monitoring activities, such as fund accounting, financial reports, and internal and external audits, to control the behavior of politicians [Baber, 1983; Berry and Wallace, 1986; Ingram, 1984; Ingram and Copeland, 1981; Wallace, 1980; Wallace, 1986].

We suggest that politicians or bureaucrats may circumvent these monitoring activities and induce the audit function to make false sign-offs to suppress the "bad news" effect of negative audit reports. (Wells [1985] presented a case of such an occurrence in state government.) Our rationale is that expanded scope audits are more widely employed in governmental units than in private enterprise organizations [Berry and Wallace, 1986]. This results in a broader review of management and decision-making activities than attest and financial audits, with the potential for more negative findings that reflect on the leadership and management abilities of the politician. Further, since governmental audit reports are usually public information, more frequent media disclosure of negative findings tends to occur from these reports. These disclosures could have a negative effect on a politician's chances for reelection or a bureaucrat's chances for reappointment. This type of political environment is not faced by private enterprise auditors.

Another difference between governmental auditors and private enterprise auditors is the concern that independent CPAs have with firm reputations [DeAngelo, 1981]. Disclosure of false sign-off rates would have a more negative impact on a public accounting firm's reputation and its ability to hold and obtain new clients. Therefore, public accounting firms would likely have more controls to prevent false sign-offs, so one would expect higher false sign-off rates among governmental auditors.

A final factor that distinguishes the CPA from governmental auditors in our view relates to the CPA's license to practice. If practicing CPAs do not follow generally accepted auditing standards, they stand to lose their licenses to practice. While some governmental auditors may be CPAs, government auditors do not rely on this license to practice governmental auditing. They are regulated by the governmental unit's policies, and most come under the protection of a civil service system (discussed later). This suggests that the penalties for false sign-offs are more severe for practicing CPAs. Thus, we believe the difference in licensing requirements to practice would also contribute to higher false sign-off rates among governmental auditors in general compared to practicing independent CPAs.

In summary, previous research in private enterprise auditing on false sign-offs cannot be extrapolated to the governmental audit case. Therefore, the major purpose of this study is to explore whether false sign-off rates do exist among governmental auditors in general and to what extent. In addition, we identified some intuitively appealing factors that might explain the differences among different classes of governmental auditors. These factors are briefly discussed in the next four sections.

Level of Government

We speculate that the level of government will affect the pattern of false sign-off rates among governmental auditors for two reasons. First, governmental auditors at the federal level are required by law to follow the GAO auditing standards, but governmental auditors at the state level cannot be legally required by the GAO to follow these standards. Although state and local auditors are strongly encouraged to do so, surveys have reported that state and local governments have not widely accepted the GAO auditing standards [Dykes and Liao, 1984/85]. The failure to adopt a formal set of auditing standards imposes fewer constraints to guide and control (1) the influence of management over the audit function and (2) the performance of the individual auditor. We believe that this environment would contribute to a higher false sign-off rate at the state level compared to the federal level.

A second reason to expect the level of government to affect the false sign-off rate relates to the establishment of quality controls and sanctions. We believe that politicians have an incentive to resist the establishment of outside quality-assurance reviews over the audit function because this type of review would weaken the politician's influence on the audit function. As reported earlier, although federal auditors are now subject to quality-assurance reviews, there is no evidence that these reviews have been implemented to any appreciable extent in state audit organizations. This creates an environment at the state level that may facilitate the politician's influence over the audit function. Based on the failure of all state governments to establish mandatory quality assurance reviews and their failure to adopt the GAO auditing standards, we expected to find the false sign-off rate higher at that level.

Independence

We expected that audit independence would also have an effect on the pattern of false sign-off rates among governmental auditors. Auditors' independence can be affected by their place within the organizational structure of the governmental entity to which they are assigned and also by whether they are auditing internally or externally. Internal auditors[1] have a higher probability of being placed within the organizational structure where they can be influenced by the management process they are auditing. External auditors, on the other hand, are presumed to be independent of the audited entity, assuming there are no personal or external impairments [GAO, 1981, pp. 19–20].

We believe that governmental internal auditors are less likely to be independent of higher government officials than governmental external auditors because they are more likely to have external impairments to the formation of independent and objective opinions and conclusions. The GAO Auditing Standards define external impairments as the ability of officials external to the audit organization to influence the: (1) assignment of audit personnel, (2) allocation of resources to the audit organization, (3) auditor's judgment as to the appropriate content of an audit report or selection of what is to be audited, and (4) continued employment of the auditor for reasons other than competency [GAO, 1981, p. 19]. Based on this rationale, we expected to find higher false sign-off rates among governmental internal auditors than among governmental external auditors.

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[1] Governmental internal auditors are defined as governmental employees reporting to a head auditor who is appointed and is primarily responsible to an official of an executive body at the level of government in which appointed. Governmental external auditors are defined as governmental employees reporting to a head auditor who is appointed or elected and is primarily responsible to a legislative body at the level of government in which appointed [GAO, 1981, pp. 19–21].

Civil Service Protection

Whenever feasible, governmental auditors should be employed under a personnel system where compensation, training, job tenure, and advancement are based solely on merit [GAO, 1981, p. 20]. Generally, a civil service system is designed to meet this objective by providing employment protection from politicians who, after an election, may fire employees and appoint political cronies to an audit position without regard to qualifications, and who could also influence the independent judgment of the auditor through other personnel actions as discussed in the previous section. Thus, we expected to find false sign-off rates higher among those governmental auditors who were not protected by a civil service system.

Certification

To be certified, a CPA or CIA must meet a minimum set of educational, experience, and ethical standards, and the penalty for not maintaining these standards could be the loss of certification. The penalty is more severe for CPAs in public accounting than those in governmental auditing because CPAs in public accounting convicted of violating the AICPA code of ethics can lose their license to practice accounting, whereas governmental auditors have no single profession-wide certification program. Although some governmental auditors are certified from previous practice in industry or are certified to enhance their professional credentials, there is no requirement that they be certified. The behavior of governmental auditors is controlled primarily by governmental policies and regulations and not by the standards of certification bodies. Thus, we expected that certification would have little effect on the false sign-off rates between categories of governmental auditors.

RESEARCH METHOD

A questionnaire was mailed to a sample of 1,600 auditors selected randomly from the membership list of the Association of Government Accountants (AGA). (Part of the questionnaire appears in Appendix A.) The list was stratified into federal, state, and local members to test the level-of-government effect. The size of the sample within each stratum was based on the percentage relationship of that stratum, as reflected in the membership list, to the overall number of AGA members in all three categories. Those members of the AGA whose job category was other than governmental auditing were excluded from the sampling procedures. The AGA membership was selected as the sampling frame because that organization has more governmental auditors than any other professional organization. The first questionnaire item qualified the respondent as to performance of work as a governmental auditor in the last five years. The respondents answering no were excluded from the overall sample and were asked to mail the questionnaire back without completing it.

Two weeks after the first questionnaire, a follow-up questionnaire was

TABLE 1
PROFILE OF RESPONDENTS

Demographic Variable	*Number*	*Percent*
Level of Government at which Employed		
Federal	495	55.6
State	295	33.1
Local	101	11.3
Total	897	100.0
Number of Years Employed as a Governmental Auditor		
0–2 years		7.9*
2–5 years		21.1
6–10 years		23.8
11 and above		47.2
Total		100.0
Type of Certification		
Certified Public Accountant		13.2**
Certified Internal Auditor		30.4**
Position of Head Auditor		
Elected		13.3*
Appointed, reporting to legislature		26.2
Appointed, reporting to executive branch		60.5
Working Under a Civil Service System?		
Yes		75.6*
No		24.4

* Percentages have been adjusted for missing values and nonresponses.
** Some respondents indicated that they were both a CPA and a CIA.

mailed to all sample members who had not responded. A test for nonresponse bias yielded no statistical difference between responses received before and after the follow-up. A total of 1,042 usable responses were received, representing a response rate of 65.1 percent. Of this total, 897 individuals (86.1 percent) affirmed working in governmental auditing at some time during the preceding five years. A more detailed demographic profile of the respondents is displayed in Table 1.

In addition to demographic questions, each respondent was asked to answer ten questions that would indicate a false sign-off if answered affirmatively (see Appendix A). The first nine questions asked if the respondent had ever, whether because of time pressure or for another reason, indicated on working papers that a specific audit procedure had been performed, when in fact it had not. The tenth question asked directly whether the respondent had ever accepted a bribe. The first nine questions addressed key audit procedures in a financial and compliance type audit, the most common types of audits conducted at all levels of government. The questions were selected because of their commonality to all groups of governmental auditors. Failure to perform or truthfully document any of these procedures would seriously compromise the responsibility of the auditor and seriously weaken the value of the audit report to the users. The acceptance of a bribe would constitute one of the most serious instances of fraud that could be committed by a governmental official of any rank or position.

Because the failure to perform any of the procedures or the acceptance of a bribe could provide the basis for dismissal proceedings against the respondent, respondents could be expected to conceal such misdeeds. To offer anonymity to individual respondents and encourage truthful responses, a randomized-response (RR) questionnaire (see Warner [1965], for example) was used. This technique has been used in accounting research by Buchman and Tracy [1982] and Buchman [1983] in their studies mentioned above, and the validity of the RR method in eliciting responses to sensitive questions was demonstrated by Tracy and Fox [1981].

A questionnaire based on the RR technique presents each sensitive question in tandem with an innocuous question. The respondent is asked to select and answer one question in each pair based on the outcome of a random process. In this study, the random process was the occurrence of specified digits in the serial number of a currency bill drawn from the respondent's own wallet. Although the random process prevents the experimenter from ascertaining which question in each pair an individual respondent selects, the expected proportion of all respondents answering the sensitive question can be computed. The mathematical procedure for these calculations has been demonstrated by Greenberg et al. [1969], and a summary is presented in Appendix B.

ANALYSIS AND FINDINGS

Table 2 displays a summary of the responses to each of the ten sensitive questions. Column 2 gives the estimated percentage of false sign-offs by all governmental auditors to each of the ten questions. Negative rates can arise because of the adjustment to account for expected responses to the innocuous questions. Of the seven items in column 2 with positive false sign-off rates, four are significantly greater than zero at the .01 level. This suggests that a statistically significant, though small, percentage of governmental auditors have failed to apply proper auditing procedures in four of ten key areas of a financial or compliance audit. The following discussion breaks down the findings in Table 2 with respect to the characteristics of governmental auditors and their environment.

Level of Government

We postulated that the false sign-off rates of state auditors would be higher than those of federal auditors.[2] The data on this point are shown in columns 3 and 4 of Table 2. The sign-off rate for state auditors was higher than for federal auditors for seven questions, and these differences were significantly greater on questions 4 and 9. The federal auditors were higher on only three questions, and none of these differences was significant. For questions 3 and 10, the two most sensitive questions asked, both groups had a zero or negative false sign-off rate. This result suggests that neither federal nor state governmental auditors are likely to accept a bribe or fail to carry out their responsibility to report fraud.

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[2] We originally intended to compare the false sign-off rates of local auditors to those of federal auditors and then to those of state auditors. However, the number of local auditors responding (101) was too low for the RR method to (1) provide meaningful comparisons and (2) to assess significance of individual false sign-off rates when compared to zero. Therefore, these tests were not made with respect to local auditors. Further research that includes a larger sample of local auditors will be required.

Because some of the differences are very large (questions 4, 7, and 9), there is the suggestion that the state group may have a higher incidence of false sign-offs. However, the sensitivity of the test as well as the RR technique preclude a strong assertion to this effect.

Independence

We also postulated that governmental internal auditors and governmental external auditors would have different false sign-off rates because of the organizational independence factor. Specifically, we thought internal auditors would be more likely to experience external impairments to independence and therefore would have a higher false sign-off rate. However, the results in columns 5 and 6 of Table 2 do not suggest that this is so. On six of the ten questions, external auditors had higher false sign-off rates, though none tested significantly higher.

We analyzed state internal and external auditors and federal internal and external auditors separately and found essentially the same results. We were somewhat puzzled at these findings and can only speculate on the reasons. Perhaps governmental external auditors are not as independent as we had theorized, or perhaps internal auditors are more independent. This could be particularly true at the federal level where the agency head may supervise several management levels and where the internal audit head could be relatively independent from the lower operating levels.

Civil Service Protection

We predicted that civil service protection would tend to insulate the audit function from the influence of politicians. Columns 7 and 8 of Table 2 show that auditors not under a civil service system had higher false sign-off rates on six out of ten questions. The rates were significantly higher on question 5. Four questions had higher false sign-off rates for auditors who were under a civil service system, but none was significant. These results suggest that lower false sign-off rates tend to be weakly associated with a civil service system. Finding significant differences on only one out of ten questions, and given the sensitivity of the test and the nature of the RR technique, precludes a stronger assertion to this effect.

Certification

Finally, we postulated that professional certification as a CPA or CIA would have little association with incidence of false sign-offs between federal auditors and state and local auditors. Our reasoning was that neither group is required to be certified, and there are no sanctions against a governmental auditor *per se* for violating the code of ethics governing CPAs and CIAs. Columns 9 and 10 of Table 2 show that auditors who were not certified had a higher false sign-off rate on eight questions. The differences on questions 4 and 10 were significant. On the other two questions, those who were certified had higher rates than those who were not certified. None of these was significant. These findings suggest—contrary to our expectations—that certification may have some effect on false sign-offs among governmental auditors.

TABLE 2
SUMMARY OF QUESTIONNAIRE RESPONSES (ALL NUMBERS ARE IN PERCENTAGES)#

Potential Area of False Sign-Off (*1*)	*All Gov't. Auditors* (*2*)	*Federal* (*3*)	*State* (*4*)	*Gov't. External* (*5*)	*Gov't. Internal* (*6*)	*Civil Service* (*7*)	*No Civil Service* (*8*)	*CPA or CIA* (*9*)	*Not CPA or CIA* (*10*)
1. Reporting Cash Discrepancy									
Percent	2.9%*	3.0%	1.5%	3.3%	1.1%	1.6%	1.5%	2.6%	3.4%
Difference		1.5%		2.2%		0.1%		−0.8%	
2. Reviewing Disbursements									
Percent	1.3	1.5	0.5	−4.2	0.8	−1.4	−4.6	1.8	1.0
Difference		2.0		−5.0		3.2		0.8	
3. Reporting Fraud									
Percent	−0.7	−0.5	−2.4	−1.8	1.7	1.4	−0.4	0.3	−1.6
Difference		1.9		−3.5		1.8		−1.9	
4. Reporting Unauthorized Expenditures									
Percent	0.9	0.2	6.5**	0.1	−0.4	−1.2	−0.2	−4.6	4.3*
Difference		−6.7*		0.5		−1.0		−8.9**	
5. Reporting Inv. Discrepancy									
Percent	4.1**	4.5**	5.0*	7.9**	−1.0	0.0	12.6**	5.2*	3.2*
Difference		−0.5		8.9		−12.6**		2.0	
6. Falsifying Payroll Audit Scope									
Percent	0.0	−1.0	0.5	4.8	−3.5	−1.0	−1.5	−0.1	0.5
Difference		−0.6		8.3		0.5		−0.6	
7. Falsifying Procurement Audit Scope									
Percent	4.6**	3.9*	8.7***	4.8	7.6**	5.7**	15.0***	3.6	5.2**
Difference		−4.8		−3.6		−9.3		−2.4	

TABLE 2—*Continued*

Potential Area of False Sign-Off (*1*)	*All Gov't. Auditors* (*2*)	*Federal* (*3*)	*State* (*4*)	*Gov't. External* (*5*)	*Gov't. Internal* (*6*)	*Civil Service* (*7*)	*No Civil Service* (*8*)	*CPA or CIA* (*9*)	*Not CPA or CIA* (*10*)
8. Falsifying Logistics Audit Scope									
Percent	0.8	0.9	2.0	−3.0	2.9	2.0	3.4	0.0	1.1
Difference		−1.1		−5.9		−1.4		−1.1	
9. Falsifying EDP Audit Scope									
Percent	6.0***	3.9*	14.0*	8.6**	6.9**	6.7**	11.5**	4.2*	7.3***
Difference		−10.1**		1.7		−5.8		−3.1	
10. Accepting a Bribe									
Percent	−1.7	−1.9	−1.6	−1.0	−2.5	−2.7	−1.3	−4.3	0.7
Difference		−0.3		1.5		−1.4		−5.0*	

A sample result of less than zero is due to a lower than expected number of yes responses to the innocuous question. A one-tailed test was used for each area of false sign-off, and a two-tailed test was used for the difference in each area.

* Significant at .10 level.

** Significant at .05 level.

*** Significant at .01 level.

Finally, we compared false sign-off rates for similar questions used in studies of private enterprise internal auditing to those in our study. Studies of independent CPAs did not contain similar questions. Of those questions that were similar, governmental auditors had a higher false sign-off rate on three, while private enterprise internal auditors had a higher rate on the remaining two. When both sets of ten questions were considered, regardless of similarity, private enterprise internal auditors only had a false sign-off rate significantly greater than zero at the .10 level on two of their ten questions while governmental auditors had a significantly higher rate on four of their ten (as this study previously indicates). This weakly supports our assumption that the false sign-off rates are different between private enterprise and governmental auditors.

SUMMARY AND CONCLUSIONS

This exploratory study gathered information about false sign-offs in selected key areas of governmental audit. We were aware at the outset that prior studies have reported false sign-off rates among certain classes of auditors, but these studies either excluded governmental auditors or included them only in a minor way. Also, we argued that the nature and practice of governmental auditing is considerably different from private enterprise auditing. In addition, the study attempted to identify differences in the extent of any false sign-offs across certain characteristics of governmental auditors and their environment. These characteristics were the level of government at which an auditor works, the organizational independence of an auditor, the existence of civil service protection, and an auditor's certification as a CPA or CIA.

The results indicate that there were significant sign-offs in four out of nine auditing procedures relating to a financial or compliance-type audit among the 897 responding governmental auditors taken as a whole. No group had a significant positive result on the question of having ever taken a bribe. State auditors had significantly higher false sign-off rates than federal auditors on two of the ten questions.

Governmental external auditors indicated slightly more false sign-offs than governmental internal auditors. We had expected the opposite effect, but since none of the differences was significant, we concluded that independence was not useful in explaining differences in false sign-off rates among governmental auditors.

Governmental auditors under a civil service system indicated significantly higher false sign-off rates on one of the ten questions. Governmental auditors who were certified as a CPA or CIA had significantly higher false sign-off rates than those who were not certified on two of the ten questions. We had expected that certification would have little effect on the false sign-off rates of governmental auditors.

On the basis of the survey we conclude that there were significant false sign-off rates among governmental auditors as a whole. The results suggest that level of government, civil service protection, and certification might be useful in attempting to identify some differences in these false sign-off rates across certain characteristics of governmental auditors and their environment. However, these points should be interpreted in light of the fact that of 40 different tests, only five tests found significant differences and in light of the sensitivity and nature of the RR technique. Although there are indications that some governmental auditors have falsely signed off on auditing procedures, information about the number of times they have done so and how long ago is not available. Furthermore, the data for this study were drawn from a representative sample of governmental auditors who belong to the Association of Government Accountants. Although a large percentage of federal and state auditors belong to this organization, they may not be representative of all governmental auditors at these levels of government.

Future studies should investigate the incidence of false sign-offs in other areas of governmental audit work. Also, why certain audit procedures have a higher false sign-off rate than others should be investigated to identify incentives that might be helpful in explaining the occurrence of false sign-off rates. An agency theoretic framework might be helpful in this regard.

APPENDIX A

A STUDY OF THE CONDUCT OF GOVERNMENT AUDITORS IN PERFORMING AUDITING PROCEDURES

(Note: Please *DESTROY* this page after entering your answers on the ANSWER SHEET.)

II. *Instructions.* The following questions ask you to provide some information that may be sensitive, so we are using an unusual technique to neutralize your answers. Specifically, an innocuous masking question is paired with every potentially sensitive question below. You will be asked to answer only one question in each pair, and only you will know whether the question you answered was the potentially sensitive question or the innocuous masking question.

To accomplish this, you will be asked to use the serial number on a currency bill taken from your wallet to determine which question in each pair to answer. Only you will know the bill's serial number. Statistically we know the number of respondents answering each question *in total*, so we can estimate the *aggregate* answer to each. At this point, please take a currency bill from your wallet. You will need only the last three digits of the bill's serial number. As noted at the top of this page, you *DESTROY* this page after entering your answers on the ANSWER SHEET so you may record the last three digits of your bill's serial number in the space below for easy reference:

___ ___ ___

Now, please record your answer to the question you select from each of the following pairs of questions, on the ANSWER SHEET.

1. If the LAST digit of your bill's serial number is 4, 5, or 6 answer question 1A; otherwise answer question 1B.
   - 1A. Is the LAST digit of your bill's serial number even?
   - 1B. Have you ever, whether because of time pressure or other reasons, failed to indicate on audit working papers a discrepancy between the amount of cash that you physically counted and the cash account balance (regardless of the amount involved)?
2. If the NEXT TO LAST digit of your bill's serial number is 4, 5, or 6 answer question 2A; otherwise answer question 2B.
   - 2A. Is the NEXT TO LAST digit of your bill even?
   - 2B. Have you ever, whether because of time pressure or other reasons, indicated in any way on the audit working papers that you have carried out an audit procedure regarding the review of an audited organization's internal control over approvals of cash disbursements, when in fact you did not?
3. If the THIRD TO LAST digit of your bill's serial number is 4, 5, or 6 answer question 3A; otherwise answer question 3B.
   - 3A. Is the THIRD TO LAST digit of your bill's serial number even?
   - 3B. Have you ever, whether because of time pressure or the extra paperwork involved or any other reason, failed to report the occurrence of fraud (regardless of amount involved)?
4. If the LAST digit of your bill's serial number is 7, 8, or 9 answer question 4A; otherwise answer question 4B.
   - 4A. Is the LAST digit of your bill's serial number odd?
   - 4B. Have you ever, whether because of time pressure or other reasons, failed to report the expenditure of government funds for purposes other than those authorized by government regulation or appropriations?

APPENDIX A—*Continued*

5. If the NEXT TO LAST digit of your bill's serial number is 7, 8, or 9 answer question 5A; otherwise answer question 5B.
   - 5A. Is the NEXT TO LAST digit of your bill's serial number odd?
   - 5B. Have you ever, whether because of time pressure or other reasons, failed to indicate on audit working papers a discrepancy between the quantity of inventory that you physically counted and the inventory account balance (regardless of the quantity involved)?
6. If the THIRD TO LAST digit of your bill's serial number is 7, 8, or 9 answer question 6A; otherwise answer question 6B.
   - 6A. Is the THIRD TO LAST digit of your bill's serial number odd?
   - 6B. Have you ever, whether because of time pressure or other reasons, indicated in any way on the audit working papers that you examined more payroll transactions than you actually did?
7. If the LAST digit of your bill's serial number is 1, 2, or 3, answer question 7A; otherwise answer question 7B.
   - 7A. Is the LAST digit of your bill's serial number odd?
   - 7B. Have you ever, whether because of time pressure or other reasons, indicated in any way on the audit working papers that you carried out an audit procedure regarding reviewing and testing internal control of purchase orders and procurement, when in fact you did not?
8. If the NEXT TO LAST digit of your bill's serial number is 1, 2, or 3 answer question 8A; otherwise answer 8B.
   - 8A. Is the NEXT TO LAST digit of your bill's serial number odd?
   - 8B. Have you ever, whether because of time pressure or other reasons, indicated in any way on the audit working papers that you examined more supply (logistics) transactions (e.g., shipments, receipts, issues and turn-ins) than you actually did?
9. If the THIRD TO LAST digit of your bill's serial number is 1, 2, or 3 answer question 9A; otherwise answer question 9B.
   - 9A. Is the THIRD TO LAST digit of your bill's serial number odd?
   - 9B. Have you ever, whether because of time pressure or other reasons, indicated in any way on the audit working papers that you carried out an audit procedure regarding review and testing of internal control of an EDP system, when in fact you did not?
10. If the LAST digit of your bill's serial number is 4, 5, or 6 answer question 10A; otherwise answer question 10B.
    - 10A. Is the LAST digit of your bill odd?
    - 10B. Have you ever accepted a bribe (regardless of the amount)?

APPENDIX B

STATISTICS OF THE RANDOMIZED RESPONSE TECHNIQUE

Let N = the total number of responses to the pair of questions,
n = the number of yes responses to the pair of questions,
p = the probability of answering the sensitive question in the pair,
$1-p$ = the probability of answering the innocuous question in the pair,
θ = the probability of a yes response given the innocuous question, and
π = the probability of a yes response given the sensitive question.

Then,

$$P(\text{yes response}) = P(\text{yes response} \mid \text{sensitive question})P(\text{sensitive question}) + P(\text{yes response} \mid \text{innocuous question})P(\text{innocuous question}).$$

Mathematically, this is equivalent to:

$$n/N = \pi p + \theta(1-p). \qquad (1)$$

Solving equation (1) for π yields

$$\pi = [n/N - (1-p)\theta]/p. \qquad (2)$$

It follows [see Greenberg et al., 1969] that

$$VAR(\pi) = [n/N(1-n/N)]/Np^2, \qquad (3)$$

and $(\pi - 0)/\sqrt{Var(\pi)}$ follows a standard normal distribution.

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The Budgeting Games People Play

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ABSTRACT: Managers would likely have different ways, termed games, of coping with their superior's budgetary leadership style and the interpersonal stress associated with budgeting. Additionally, these factors are likely to be associated with different budgetary attitudes. We examined the patterns of gameplay as well as leadership styles and role stress to determine whether these factors were correlated with the subordinates' attitude toward achieving their budget. We found that the game patterns of DEVIOUS, ECONOMIC, INCREMENTAL, and TIME were correlated with subordinates' attitude toward achieving their budgets, particularly when considered in the context of their superior's leadership style and the amount of role stress present. In particular, we found that a manager with a positive budgetary attitude used the ECONOMIC, INCREMENTAL, or TIME game pattern, avoided the DEVIOUS pattern, had low role stress, and had a superior with a punitive leadership style.

GAMEPLAY in budgeting is a relatively unexplored issue. Since Hofstede's [1967] initial work, there has been little published research on that aspect of budgeting. Additionally, there has been limited work in a budgeting context concerning leadership and role stress. While Collins [1982] suggests a role theory perspective for investigating the effects of leadership styles, no comprehensive, accepted theory regarding budgeting processes exists [Hofstede, 1967; Hopwood, 1972]. This paper examines the effect of game-play, leadership style, and role stress on attitude towards achieving one's budget.

Previous research has shown that gameplay exists in a budgetary setting and that there are specific patterns or schemata of gameplay [Collins, Munter, and Finn, 1983]. In this study, we explore whether a relationship exists among leadership styles, gameplay, and budgetary attitude and the possible nature of that relationship. Additionally, we determine the extent to which role stress enters into that relationship.

We first present the research model underlying our study. Next, we discuss our experimental variables, measurement constructs, and associated research questions and hypotheses. Finally, we provide the research method, results, and concluding remarks.

RESEARCH MODEL

Our theoretical model is outlined in Figure 1. Gameplay is depicted as an intervening variable in the leadership

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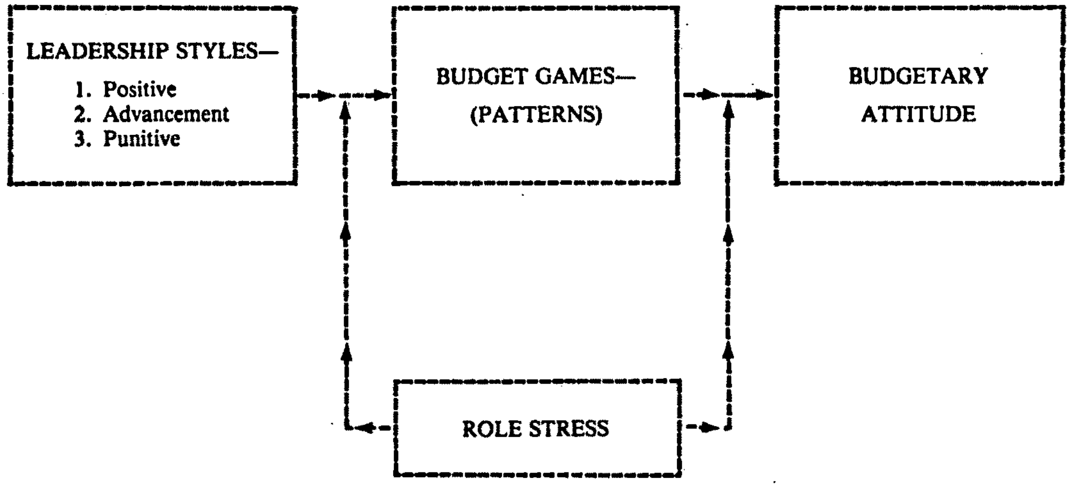
FIGURE 1

THEORETICAL MODEL OF RELATIONSHIPS AMONG LEADERSHIP, GAMES, STRESS, AND ATTITUDE IN A BUDGETARY SETTING



style-budgetary attitude chain while role stress is shown as a moderating variable.[1] We depict leadership style as an independent variable because leadership styles are used by superiors to induce desirable subordinate budgeting behaviors [Katz and Kahn, 1978; Hunt and Larsen, 1974]. Further, budget game patterns are hypothesized to be intervening variables between leadership style and budgetary attitude because a subordinate is placed between the superior's leadership style and the necessity to perform under the budget. Thus, the subordinate would involve himself in certain coping procedures or games to relieve the attendant behavioral pressure [Berne, 1964; Abelson, 1981]. Role stress is specified as a moderating variable because stress may change (or moderate) the effect of leadership and gameplay on attitudes.

EXPERIMENTAL VARIABLES

Budget Attitude

The self-reported attitude of line managers (subordinates) toward achieving their budgets is the dependent variable. This is clearly a second order, end-result variable (compared to others such as profitability, cost savings, etc.). However, it was chosen because many other factors that are largely external (weather, strikes, competitor actions, material or product shortages, general economic conditions, etc.) potentially can affect the ultimate end-result variables. Additionally, other researchers [Mirvis and Lawler, 1977; Milani, 1975; Macy and Mirvis, 1982] have found significant relationships between attitudinal variables and ultimate end-result measures.

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[1] We note that while the issue is not entirely settled, a growing number of researchers have found evidence that attitude leads to behavior (see Sears, Speer, and Hensler [1979]; Crosby, Bromley, and Saxe [1980]; Fazio and Zanna [1978]; and Regan and Fazio [1977]). Further, the general thrust of the leadership literature (see Hodgets and Altman [1979]) is that leadership is intended to and does cause behavior. Thus, consistent with these researchers, we posited that the primary theoretical path is from leadership to games to behavior, although we acknowledge the possibility of a secondary flow (behavior to games to leadership). For this reason, we make only correlational, not causal, claims.

Leadership Styles

To measure leadership style, we use the contingency approach to leadership developed by Johnson [1970] and also used by Reitz [1971] and Sims [1977].[2] In this model a leader (or superior) uses a combination of three basic leadership styles: (1) a *positive* style that encourages "good" performance by offering encouragement, praise, and other forms of support; (2) a style that offers *advancement* opportunities to those who perform well; and (3) a *punitive* style that punishes "bad" performance with reprimands, pay cuts, and threats of termination. Within the model, a leader may use either one style or a combination of styles (although one style would probably dominate). Further, the model assumes that leaders/superiors apply styles *contingent* upon past performance of their followers /subordinates, hence the contingency nature of this approach.

Our first null hypothesis to be tested empirically is:

> HO_1 There is no relationship between leadership styles and budgetary attitude.

Since standard theories of leadership imply attitudinal and behavioral effects on subordinates, one might expect a link between leadership style and budgetary attitude [Katz and Kahn, 1978; Hunt and Larsen, 1974]. If a relationship is established between leadership style and budgetary attitude, the next link in our model can be investigated—the significance of gameplay as an intervening variable.

Gameplay

Huizinga [1950], a cultural historian, concludes that much human activity consists of "games." He defines games as organized play involving set rules and specific objectives. More recently Berne, a clinical psychologist, defines games as "an ongoing series of complementary ulterior transactions (between people) leading to a well-defined outcome" [1964, p. 48]. According to Berne, individuals do not begin each transaction with a "clean slate." Rather, in repetitive situations (such as budgeting) individuals develop a repertoire of potentially useful behaviors [Abelson, 1981]. Indeed, Berne notes that personality development is primarily a matter of learning which games to play in specific situations. Similarly, Goffman [1967] asserts that individuals develop ritualistic behavior patterns for use in repetitive face-to-face interactions. These behavior patterns fit within the definitions of games offered by Huizinga and Berne.[3]

Tovey [1963], Fuyuume [1965], and Hofstede [1967] find industrial budgeting to have a gamelike nature, and Wildavsky [1974, 1975] provides evidence of gameplay in congressional budgeting. We define games as *routinized behaviors adopted by subordinates to cope with pressures inherent in the budgetary negotiation process.*

Collins et al. [1983] and Collins, Munter, and Clancy [1984] showed that gameplay exists in a budgetary setting and that there are different repertoires or patterns of gameplay.[4] Appendix A summarizes how the following four gameplay patterns were identified using questions developed by Collins et al. [1983]:

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[2] For an excellent discussion of the various leadership approaches, see Hodgets and Altman [1979] or Hunt and Osborn [1981].

[3] Early researchers in this area include Piaget [1926], Bartlet [1932], and Goffman [1959]. More recent works include those of Abelson [1981], Cantor and Mischel [1979], Mandler [1978], and Markus [1977].

[4] We assume that each individual might possess a repertoire of several games for dealing with the budgetary process. A repertoire would give the individual a choice of approaches. Further, the repertoire of games would be logically consistent since a subordinate's behavior would likely have a measure of consistency. We would refer to the game cluster as a gameplay pattern.

DEVIOUS, ECONOMIC, INCREMENTAL, and TIME.

We next investigated the significance of gameplay as an intervening variable in the relationship of leadership style to budgetary attitude. Of course, budgetary gameplay could exist and yet have no bearing on leadership/attitude relationships in the budgeting process. If this were true, gameplay would be an expression of personal style rather than an explanation of budgetary attitude. Thus, we have a second null hypothesis:

> HO_2 Gameplay patterns, as intervening variables, will not improve the association between leadership styles and budgetary attitude.

If gameplay acts as an intervening variable, then gameplay patterns should help explain a subordinate's behavioral reaction (as measured by budgetary attitude) to a superior's leadership style.

Role Stress

Interpersonal role stress affects the effectiveness and efficiency of relations [Van Sell, Brief, and Schuler, 1981]. According to role theory, people in organizations associate "roles" or behavioral expectations with functional positions [Katz and Kahn, 1978]. These expectations are held by both the subject person and others in the organization. For example, managers are often expected to enact a "superior" role where their behaviors are friendly but demanding, knowledgeable, and decisive. Role stress, the amount of interpersonal strain in role relationships, is commonly described in terms of role ambiguity and role conflict [Kahn et al., 1964]. Role ambiguity measures *uncertainty* among relevant actors regarding the "proper" role while role conflict measures *disagreement*. Together, role conflict and role ambiguity constitute a measure of role stress.[5]

Even if role stress exists, it might be unrelated to budget gaming, and thus, we have our final null hypothesis:

> HO_3 Role stress does not act as a significant moderating variable in the leadership style-budgetary gameplay-budgetary attitude relationship.

RESEARCH METHOD

Based on the results of a case study and an expert panel [Collins et al., 1983], we prepared a questionnaire regarding demographic data,[6] budgetary attitude, leadership styles, budget games, and role stress. The questionnaire was reviewed for meaningfulness and understandability by the controllers and budgeting staff of a multinational energy company. This firm was chosen due to its operational diversity and strong commitment to budgetary processes. Next, we mailed questionnaires to members of the Planning Executives Institute and the National Management Association. Responses were received from 1,021 planning executives and 318 managers (response rates of 30 percent and 24 percent, respectively).[7]

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[5] In this study we chose not to decompose role stress into the two dimensions of conflict and ambiguity for two reasons. First, some researchers (see Bellenger, Chonko, and Howell [1982]) suggest that this decomposition may not be supportable. Second, our focus is on gameplay and parsimony urged us to analyze only the combined variable.

[6] The average manager responding to our survey was 48 years old, had a college education, was male, had been with his organization for 17 years (eight years at present level), and was a mid-level manager in an organization of 20,432 employees. These demographic characteristics are representative of the "typical" member of the organization we used to develop our mailing list.

[7] Since the questionnaire was anonymous, it was not possible to directly evaluate the effects of nonresponse bias. However, statistical tests indicated that the demographic characteristics of the respondents and the demographic profiles of the P.E.I. and N.M.A. memberships

TABLE 1

QUESTIONNAIRE ITEMS FOR OVERALL BUDGETARY ATTITUDE

	Questionnaire Items	*Average Response**	*Standard Deviation*
1.	I frequently make a sincere personal effort to achieve my budgetary objectives.	5.86	1.17
2.**	I never get what I want in my budget.	3.28	1.71
3.	I often receive recognition for achieving budget goals.	4.73	1.67
4.**	I frequently allow erroneous or incompatible data to be put into the budget process even though this may hamper budget administration.	4.67	1.38
5.	My budget requests are often approved.	5.31	1.27
6.	I often exceed my approved budget objectives.	3.81	1.67
7.	I frequently feel a personal sense of failure when budget objectives are not met.	4.02	1.70
8.**	I frequently withhold my full support of the budget.	4.38	1.48
9.	My boss believes budgeting is very important.	5.44	1.57
	Average	4.87	1.60

* 1 = strongly disagree, 7 = strongly agree.

** Questions were reverse scored for analysis.

Measurement of Research Variables

Budgetary attitude was measured with questions developed by Collins [1978]. Table 1 shows the questions (and the average and standard deviations of responses) that were asked of each subordinate.[8] Subordinates are considered to have a positive attitude if they strive to meet or exceed their budget, ego-identify with their budget, or strive to induce other subordinates to achieve their budgets. They are considered to have a negative attitude when they withhold support of the budget, do not strive to induce other subordinates to achieve their budgets, or attempt to sabotage the budget or budget process. Respondents used a seven-point Likert scale, where one = strongly disagree and seven = strongly agree. The nine responses for the individual were averaged to yield a measure of "Overall Budgetary Attitude" for each individual. This variable was the dependent variable in the subsequent regression analyses.

Table 2 shows the questions used to measure leadership styles and the average responses and standard deviations. Based upon the work of Johnson [1970], we developed three leadership style variables: positive, advancement, and punitive. The leadership style variables are computed by averaging the individual's responses (on a seven-point Likert scale) to the questions shown in Table 2. The three leadership style variables were independent variables in the regression models.

(the latter demographics were obtained from organization records) were comparable. Also, see footnote 13 and related discussion.

[8] The actual questionnaire presented these questions as well as those in Tables 2–4 in random order.

TABLE 2

QUESTIONNAIRE ITEMS FOR LEADERSHIP

Questionnaire Items	*Average Response**	*Standard Deviation*
Positive Leadership Style:		
1. My boss would personally pay me a compliment if I did outstanding work in preparing my budget.	5.19	1.53
2. My boss would lend a sympathetic ear if I had a complaint about my budget.	4.76	1.51
3. My boss would give me special recognition if my work performance in preparing my budget was especially good.	4.01	1.66
4. My boss would show a great deal of interest if I suggested a new and better way of preparing the budget.	4.73	1.71
5. My boss would do all he/she could to help me if I were having problems in preparing my budget.	4.86	1.67
Average	4.61	1.61
Advancement Leadership Style:		
1. My boss would see that I will eventually progress as far as I would like to in this organization if my work in preparing my budget is consistently above average.	3.48	1.72
2. My boss would recommend that I be promoted if my work in preparing my budget was better than others who were otherwise equally qualified.	3.61	1.63
3. My boss would tell his/her boss if my work in preparing my budget was outstanding.	4.17	1.83
4. My boss would recommend that I not be promoted to a higher job level if my performance in preparing my budget was only average.	3.65	1.62
Average	3.72	1.69
Punitive Leadership Style:		
1. My boss would reprimand me (written or verbally) if my work in preparing my budget was consistently below acceptable standards.	4.99	1.71
2. My boss would criticize me if my work in preparing my budget was not as good as the work of others at my level.	4.62	1.59
3. My boss would recommend against a pay increase for me if my work in preparing a budget was substandard.	4.02	1.82
Average	4.54	1.77

* 1 = strongly disagree, 7 = strongly agree.

Gameplay variables were developed for this study based upon the responses to the 13 questions in Table 3. Based upon the work of Collins et al. [1983], four games were identified (see Appendix A). The DEVIOUS gameplay pattern is determined by averaging the individual's responses (on a seven-point Likert scale) to questions 1-7, the ECONOMIC pattern by the responses to 8-11, the TIME pattern by 12-13, and the INCREMENTAL pattern by 1-2.

Table 3
Questionnaire Items for Games

*Questionnaire Items**	*Name of Behavior***	*Average Response†*	*Standard Deviation*
DEVIOUS game pattern:			
1. I try hard to keep what I had in last year's (period's) budget.	Horatio at the bridge	4.40	1.79
2. I get changes in my budget by seeking incremental changes over past budgets.	Incremental	4.49	1.70
3. I rely on friendship with my boss to get what I want in my budget.	Relying on friendship	2.33	1.42
4. I ask for a small item in the budget knowing that I can ask for a lot more next time once it's in the budget.	Camel's nose	2.62	1.56
5. I get what I want in my budget by letting my boss think my operation has a crisis and must have the budgetary request.	Crisis	2.30	1.28
6. I place some items in my budgetary request which I know will not be approved so that those requests will be cut instead of items I really want approved.	Sacrificial lamb	2.91	1.81
7. I attach items that are likely to be cut from the budget if separately submitted to other projects that are certain to be approved.	Piggyback	2.64	1.60
Average		3.09	1.40
ECONOMIC game pattern:			
8. I invite my boss to my work area so that he can see what I really need in my budget.	On-site visits	4.29	1.91
9. If my boss won't give me what I want in my budget, I tell him: "We'll simply have to shut down. Unless we get the full budget amount, we just can't operate . . ." or something like that.	All or nothing	2.33	1.47
10. I get what I want in my budget by presenting my boss with the facts.	Presenting the facts	5.57	1.31
11. I get what I want in my budget by telling my boss that my requests will pay for themselves.	It'll pay for itself	4.78	1.60
Average		4.23	1.30
TIME game pattern:			
12. I seek the help of others (other than my boss) to get what I want in my budget.	Seeking other's help (or end run)	4.13	1.82
13. If times aren't "right," I'll wait until the next budget period to ask for things in my budget.	Right time	4.38	1.71
‡Average		4.26	1.65

Table 3—*Continued*

INCREMENTAL game pattern:			
1. I try hard to keep what I had in last year's (period's) budget.	Horatio at the bridge	4.40	1.79
2. I get changes in my budget by seeking incremental changes over past budgets.	Incremental	4.49	1.70
Average		4.44	1.92

* 1 = strongly disagree, 7 = strongly agree.

** The use of phrases such as "Horatio at the bridge" is only for ease of reference to the behavior patterns. It is hoped that the reader will find these terms descriptive of the behavior pattern and find these abbreviated references helpful in subsequent discussions.

† The gameplay patterns are determined by taking the average response from the questions, such that the DEVIOUS pattern is based upon the responses to games 1–7; the ECONOMIC pattern is based on responses to games 8–11; the INCREMENTAL pattern is based on games 1 and 2; and the TIME pattern is based on games 12 and 13.

‡ The INCREMENTAL game uses questions 1 and 2 that were also part of the DEVIOUS game.

Role stress was based upon the work of Rizzo et al. [1970] and was measured by averaging the individual's responses to the 14 questions in Table 4. This role stress variable was included in the regression model to determine whether role stress acts as a moderator in the research model.

Test of Intervening and Moderating Relationships

To determine whether the gameplay patterns are intervening variables, we use path analysis as described by Reise [1974]. This test displays the structure of the relationship among the variables and will identify the leadership to gameplay to budgetary attitude relationship.

We next test whether role stress is a moderator variable. A moderator variable is said to exist if the form of the relationship between an independent variable, x, and the dependent variable, y, is changed by the introduction of the new variable, z. To determine whether role stress is a moderator variable, we determine whether there is a significant interactive effect with the other independent variables. Computationally, we compute the following regression equation:

$$y = a + b_1x + b_2z + b_3xz.$$

The new independent variable (z) is said to be a moderating variable if $b_3 \neq 0$.

Results

To test hypothesis one, we computed the association between budgetary attitude and the three leadership styles via stepwise regression[9] (the regression statistics[10] are presented in Table 5). We

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[9] The validity of our results partially depends upon the assumptions inherent in regression analysis (multivariate normality, error term independence, and constant variance) being fulfilled. The chi-square test for normality, as suggested by Johnston [1972], resulted in a failure to reject the null hypothesis of nonnormality ($\alpha < .995$). The goodness-of-fit test of residuals (see Draper and Smith [1966]) demonstrated that the model was adequately specified ($\alpha < .980$).

[10] Upon computing these regressions, the change in the mean squared error is an important determinant of the significance of the relationships. With a stepwise procedure, a significant change is deemed to be present if the adjusted R^2 increases by a statistically significant amount (see Arnold [1982]). Thus, a stepwise regression procedure is appropriate since it bases the significance levels upon a change in the error term which occurs because of the change in the model [Kerlinger, 1973, pp. 616–648]. Accordingly, while three leadership styles are addressed in the research instrument (positive, advance-

TABLE 4
QUESTIONNAIRE ITEMS FOR ROLE STRESS

	Questionnaire Items	Average Response*	Standard Deviation
1.**	I feel certain about how much authority I have in preparing my budget.	5.19	1.53
2.**	I have clear, planned budgetary goals and objectives for preparing my budget.	4.74	1.66
3.	I have to do things in preparing my budget that should be done differently.	4.22	1.71
4.**	I know that I have allocated my time properly in preparing my budget.	4.80	1.42
5.	I receive an assignment in preparing my budget without the manpower to complete it.	3.55	1.91
6.**	I know what my responsibilities are in preparing my budget.	5.64	1.33
7.	I have to buck a rule or policy in order to prepare my budget.	3.04	1.77
8.	While preparing my budget, I work with two or more groups that operate differently.	4.14	2.04
9.**	I know exactly what is expected of me in preparing my budget.	5.05	1.65
10.	I receive incompatible requests from two or more people when preparing my budget.	3.92	1.89
11.	I do things in preparing my budget that are likely to be accepted by one person and not accepted by others.	4.31	1.73
12.	I receive an assignment in preparing my budget without adequate resources to execute it.	3.60	1.80
13.**	I receive clear explanations of what has to be done in preparing my budget.	4.36	1.72
14.	I work on unnecessary things in preparing my budget.	3.32	1.71
	Average	3.40	1.34

* 1 = strongly disagree, 7 = strongly agree.
** Questions were reverse scored for analysis.

found a statistically significant relationship ($\alpha < .0004$) between attitude and leadership style, and therefore rejected HO_1. However, the practical significance of this relationship is small since the R^2 is only .04. Further, only one leadership variable is significant; it implies that punitive behavior is positively associated with budgetary attitude.

Since the first null hypothesis (HO_1) was rejected, we proceeded to test the second hypothesis (HO_2) concerning the leadership-gameplay-attitude chain and the role of gameplay as an intervening variable. First, we examined the direct effect of gameplay on budgetary attitude by regressing game patterns against atti-

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ment, and punitive), it is possible that in the test of HO_1, fewer than three of these leadership styles could have a significant impact upon the hypothesized relationship. Yet, the fact that fewer than three leadership styles enter the regression equation (using a stepwise procedure) would not hinder our ability to test HO_1 since the hypothesis is stated generally (in terms of leadership style).

TABLE 5

REGRESSION MODEL

DEPENDENT VARIABLE: BUDGET ATTITUDE
INDEPENDENT VARIABLES: LEADERSHIP STYLES (POSITIVE, ADVANCE, and PUNITIVE)

ADJ. R SQUARE=0.040

	DF	*Sum of Squares*	*Mean Square*	*Prob>F*
REGRESSION	1	8.075	8.075	0.0004
ERROR	304	194.111	0.638	
TOTAL	305	202.186		

	B-Value	*Std. Error*	*Prob>F*
Significant Independent Variable			
INTERCEPT	1.348		
PUNITIVE	0.138	0.038	0.0004
Other Independent Variables (Not Significant)			
POSITIVE	0.089	0.051	0.1850
ADVANCEMENT	−0.074	0.053	0.1650

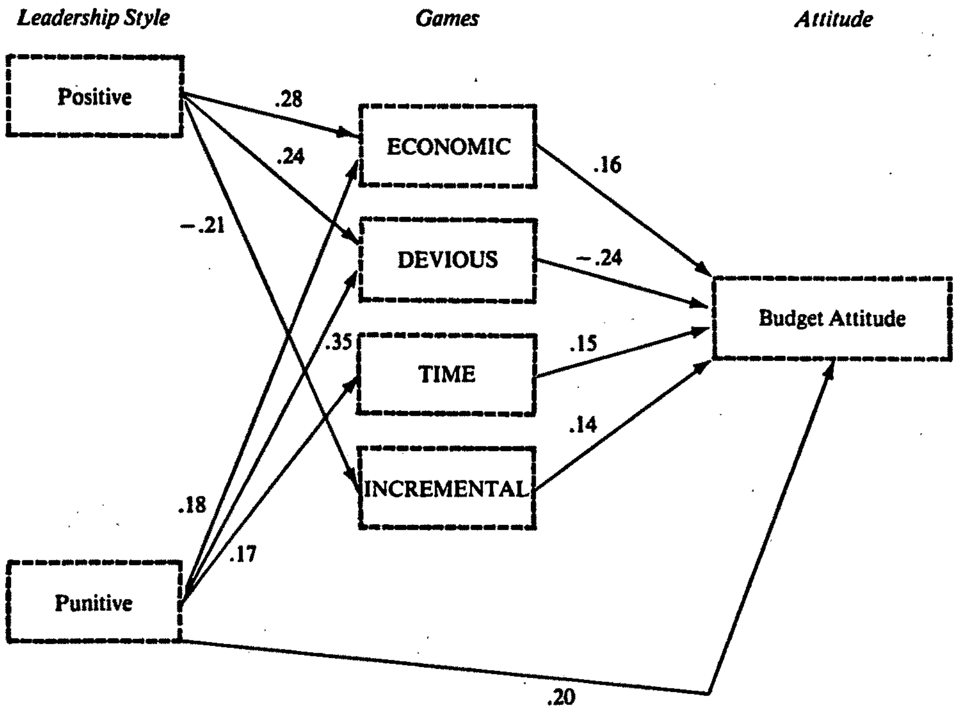
tude. An R^2 of .160 ($\alpha < .0001$) confirms a direct relationship with the gameplay variables and budgetary attitude. These results are shown in Table 6. Second, to determine whether games represent intervening variables, we conducted a path analysis for the leadership-games-attitude chain. In finding the "best" path among the variables, regressions were computed to identify the most likely path from leadership styles to budgetary attitude. (For a complete discussion of the computational procedures involved, see Reise [1974].)

The direct and indirect effects for this path model are presented in Table 7, and Figure 2 shows the significant path coefficients, computed using standardized Beta weights. Only path coefficients significant at the .05 level are included.

By scanning Figure 2, one may note that there were significant paths involving both direct and indirect relationships (these effects are further presented in Table 7). Taking all paths together, the model was able to explain 20 percent of the variance in the dependent variable, budgetary attitude. The path coefficients indicate that both punitive and positive leadership styles are linked to budgetary attitude through the budgetary games. Thus, the results of these paths indicate that budgetary games are significant intervening variables in our model.

To further explore budgetary games, budgetary attitude (dependent variable) was regressed against the three leadership styles and the four gameplay patterns (independent variables) and an interactive variable between each of the leadership styles and the gameplay patterns. Table 8 presents the significant

FIGURE 2
RESULTS OF PATH ANALYSIS FROM LEADERSHIP TO BUDGET ATTITUDE



Note: Paths not shown were not significant.
Overall $R^2 = .20$

variables when gameplay patterns are added to the model in Table 5. The addition of the gameplay variables increased R^2 from .04 to .187. The extra-sum-of-squares test (see Harris [1975], Peters and Champoux [1979], or Neter, Wasserman, and Kutner [1983]) indicates that this more elaborate regression equation was a significantly stronger explanatory model ($\alpha < .001$).[11] Therefore, the gameplay variables directly affect budgetary attitude. However, none of the interactive variables were significant at the .1 level, implying that gameplay variables do not modify the relationship between leadership styles and budgetary attitude.

Thus, we conclude that gameplay variables have both direct effects on budgetary attitude and are important *intervening* variables between leadership style and budgetary attitude.

To test the third hypothesis (HO_3), we added role stress to the independent variables used in the preceding regression equation. We used the moderated regression technique as suggested by Peters and Champoux [1979] and Sharma et al. [1981] by again including interactive variables among all the independent variable sets (leadership styles, gameplay patterns, and role stress). Thus, we have

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[11] See footnote 10.

TABLE 6
REGRESSION MODEL

DEPENDENT VARIABLE: BUDGET ATTITUDE
INDEPENDENT VARIABLES: BUDGET GAME PATTERNS (DEVIOUS, ECONOMIC, INCREMENTAL, and TIME)

ADJ. R SQUARE = 0.160

	DF	*Sum of Squares*	*Mean Square*	*F*	*Prob>F*
REGRESSION	4	31.740	7.935	13.83	0.0001
ERROR	298	171.013	0.573		
TOTAL	302	202.753			

	B-Value	*Std. Error*	*Prob>F*
Significant Independent Variables			
INTERCEPT	1.108		
DEVIOUS	−0.420	0.065	0.0001
ECONOMIC	0.198	0.051	0.0001
INCREMENTAL	0.099	0.041	0.0157
TIME	0.099	0.037	0.0073

TABLE 7
PATH COEFFICIENTS

Path	*Direct*	*Indirect*	*Residual*	*Total*
Positive Leadership on Budget Attitude		.11	−.03	.08
Punitive Leadership on Budget Attitude	.20	−.06	.03	.17
ECONOMIC Game on Budget Attitude	.16		.04	.20
DEVIOUS Game on Budget Attitude	−.24			−.24
TIME Game on Budget Attitude	.15		−.10	.05
INCREMENTAL Game on Budget Attitude	.14		−.09	.05
Positive Leadership on ECONOMIC Game	.28	.07	−.01	.34
Punitive Leadership on ECONOMIC Game	.18	−.04	.02	.16
Positive Leadership on DEVIOUS Game	.24	−.12	.01	.13
Punitive Leadership on DEVIOUS Game	.35	−.16	−.06	.13
Positive Leadership on TIME Game			.10	.10
Punitive Leadership on TIME Game	.17			.17
Positive Leadership on INCREMENTAL Game	−.21		.22	.01
Punitive Leadership on INCREMENTAL Game			.09	.09

TABLE 8
REGRESSION MODEL

DEPENDENT VARIABLE: BUDGET ATTITUDE
INDEPENDENT VARIABLES: LEADERSHIP STYLES (POSITIVE, ADVANCE, and PUNITIVE), BUDGET GAME PATTERNS (DEVIOUS, ECONOMIC, INCREMENTAL, and TIME), and INTERACTIVE VARIABLES

ADJ. R SQUARE=0.187

	DF	*Sum of Squares*	*Mean Square*	*F*	*Prob>F*
REGRESSION	5	36.909	7.381	13.31	0.0001
ERROR	290	160.867	0.554		
TOTAL	295	197.776			

	B-Value	*Std. Error*	*Prob>F*
Significant Independent Variables			
INTERCEPT	1.102		
PUNITIVE	0.462	0.183	0.0019
DEVIOUS	−0.383	0.102	0.0002
ECONOMIC	0.124	0.082	0.0131
INCREMENTAL	0.174	0.064	0.0067
TIME	0.057	0.036	0.0526
Other Independent Variables (Not Significant)			
POSITIVE	−0.448	0.276	0.1052
ADVANCEMENT	0.069	0.270	0.7979
Interactive Variables			
PUNITIVE-DEVIOUS	−0.049	0.052	0.3471
PUNITIVE-ECONOMIC	0.006	0.038	0.8808
PUNITIVE-INCREMENTAL	−0.031	0.030	0.3028
PUNITIVE-TIME	−0.020	0.028	0.4748
POSITIVE-DEVIOUS	0.088	0.068	0.1988
POSITIVE-ECONOMIC	0.089	0.056	0.1144
POSITIVE-INCREMENTAL	−0.087	0.051	0.1340
POSITIVE-TIME	0.036	0.041	0.3883
ADVANCEMENT-DEVIOUS	−0.028	0.075	0.7115
ADVANCEMENT-ECONOMIC	−0.059	0.071	0.4093
ADVANCEMENT-INCREMENTAL	0.068	0.043	0.1188
ADVANCEMENT-TIME	−0.012	0.041	0.7701

the dependent variable, budgetary attitude, and three sets of independent variables (three types of leadership styles, four patterns of gameplay, and role stress)—as well as the interactive variables.

The extra-sum-of-squares test indicates that the addition of role stress significantly improved the equation ($\alpha <$ .001). Additionally, role stress does significantly interact with the other independent variables.[12] As can be seen in Table 9, the role stress variable is individually significant in the model ($\alpha <$ .0249). Additionally, role stress has a significant interactive effect with leadership styles (the interaction between stress and punitive style is significant at the .0439 level) as well as budget game patterns (the interaction between stress and ECONOMIC is significant at the .0556 level while the interaction between stress and TIME is significant at the .0041 level). Thus, role stress has both direct and moderating effects, and hypothesis HO_3 is rejected.

DISCUSSION OF RESULTS

The final regression analysis provides some interesting insights into the budgetary process. When the gameplay variables were regressed against budgetary attitude, all four game patterns (DEVIOUS, ECONOMIC, INCREMENTAL, and TIME) were significant (see Table 7). This implies that all four behavior patterns of gameplay are practiced in the budgeting arena and help to explain the variance in budgetary attitude. (It should be noted that when the moderating effects of role stress are considered, the TIME pattern is no longer significant. Thus, it appears that much of the strength of the TIME gameplay pattern is moderated by the extent of role stress present in the budgetary setting.) The regression coefficients reported in Table 9 indicate the direction and strength of relationships between the independent variables and attitude. A subordinate who uses the DEVIOUS game pattern is most likely to have a negative budgetary attitude. Not surprisingly, a high amount of role stress is associated with a reduced budgetary attitude. Most surprisingly, the punitive leadership style was ranked the most important in providing for a positive budgetary attitude.

To provide additional insights into our experimental relationships, Spearman correlation coefficients were computed for the experimental variables used in the regression analyses. The coefficients appear in Table 10.

The coefficients reveal a number of significant relationships. For example, role stress was positively related to both the DEVIOUS game pattern ($r = .274$, $\alpha < .01$) and to the INCREMENTAL game pattern ($r = .146$, $\alpha < .05$). Evidently, individuals who use these patterns often find themselves in stressful situations. On a more positive note, reduced stress was associated with superiors who use positive leadership styles ($r = -.310$, $\alpha < .01$). Finally, by observing the correlation coefficients in Table 10, one may note that two of the three leadership styles have significant relationships with budget attitude. This finding is consistent with the contingency literature, since these coefficients imply that no one style alone is "best." Never-

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[12] To further determine whether role stress moderates the relationship among the other variables, we split the respondents into two groups: low stress (those whose response to the role stress questions was below the mean response—see Table 4) and high stress. We then performed a path analysis on the two subgroups to determine whether the form of the relationship was changed by role stress. Following the procedures described by Arnold [1982], a variable is said to alter the form of the relationship if different paths are present in the subsequent path analyses. The results of the path analyses confirmed that role stress acted as a moderating variable in the leadership-gameplay-attitude chain.

TABLE 9

REGRESSION MODEL

DEPENDENT VARIABLE: BUDGET ATTITUDE
INDEPENDENT VARIABLES: LEADERSHIP STYLES (POSITIVE, ADVANCE, and PUNITIVE), BUDGET GAME PATTERNS (DEVIOUS, ECONOMIC, INCREMENTAL, and TIME), STRESS, and INTERACTIVE VARIABLES

ADJ. R SQUARE=0.279

	DF	*Sum of Squares*	*Mean Square*	*F*	*Prob>F*
REGRESSION	6	43.886	7.314	13.83	0.0001
ERROR	282	149.195	0.529		
TOTAL	288	193.081			

	B-Value	*Std. Error*	*Prob>F*
Significant Independent Variables			
INTERCEPT	1.617		
PUNITIVE	0.140	0.043	0.0013
STRESS	−0.600	0.266	0.0249
DEVIOUS	−0.387	0.080	0.0577
ECONOMIC	0.126	0.066	0.0429
INCREMENTAL	0.096	0.047	0.0043
Interactive Variables			
STRESS-PUNITIVE	−0.385	0.190	0.0439
STRESS-ECONOMIC	−0.194	0.101	0.0556
STRESS-TIME	−0.211	0.073	0.0041
Other Independent Variables (Not Significant)			
POSITIVE	0.015	0.059	0.7997
ADVANCEMENT	−0.019	0.066	0.7797
TIME	−0.004	0.042	0.9152
Interactive Variables			
STRESS-POSITIVE	0.036	0.050	0.4771
STRESS-ADVANCEMENT	−0.003	0.056	0.9525
STRESS-DEVIOUS	−0.066	0.067	0.3255
STRESS-INCREMENTAL	0.040	0.039	0.3023

theless, the strength of punitive leadership style as an explanatory variable in our results appears to warrant additional research.

Discussion of Related Research

The results presented here are similar to those obtained in the case study con-

TABLE 10

CORRELATION COEFFICIENTS OF EXPERIMENTAL VARIABLES

	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*
1. Devious Game Pattern	1.000								
2. Economic Game Pattern	−.461**	1.000							
3. Incremental Game Pattern	.668**	.195**	1.000						
4. Time Game Pattern	.348**	.236**	.225**	1.000					
5. Positive Leadership	.081	.272**	−.016	.095	1.000				
6. Advancement Leadership	.200**	.332**	.068	.159*	.657**	1.000			
7. Punitive Leadership	.112*	.186**	.069	.167*	.218**	.448**	1.000		
8. Stress	.274**	−.070	.146*	.070	−.310**	−.074	.008	1.000	
9. Overall Budget Attitude	−.198**	.144*	−.074	.089	.127*	.092	.248**	−.314**	1.000

* Significance level ≤0.05
** Significance level ≤0.01

ducted as a preliminary step to the present study [Collins et al., 1983]. Further, the data obtained from the budget directors provided the desired convergent validity.[13] A comparison of manager/budget director responses to the gameplay questions is reported in Appendix B.

Like other research on budget gaming, our study suggests that patterns of gameplay exist—patterns not unlike those observed by Wildavsky [1975] in the U.S. Congress. Further, Hofstede's [1967] observation that a "gamelike" atmosphere enhances the budgetary effort is supported by the clear patterns of gameplay found as well as by the finding that all four patterns (particularly, DEVIOUS and ECONOMIC) are significant in explaining changes in budgetary attitude. Finally, our finding of budgetary gameplay is consistent with the work of clinical and cognitive psychologists.

Many leadership studies conclude that positive reward behavior is more effective in improving various work-related attitudes (e.g., Reitz [1971]; Sims and Szilagyi [1975]). However, several of these same studies found that punitive leadership behavior also correlated positively with satisfaction and performance (e.g., Reitz [1971]; Strasser, Daily, and Bateman [1981]). Yet, this latter group of researchers tended to give sparse treatment to the punitive findings. The contingency management approach suggests that no one approach is "best"; it depends on the context of the situation.

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[13] A test of the three response groups (case study, line managers, and budget directors) indicated that the response patterns of the three groups were not significantly different.

The stronger punitive findings from our study suggest that a more evenhanded approach is in order.

Our findings regarding stress are consistent with the work of researchers such as Rizzo et al. [1970], who suggest that ambiguity and conflict are significantly correlated. Given this and other similar findings, we feel comfortable in having used a combined measure of role stress. Further, this study lends support to the findings of Collins, Seiler, and Miller [1982], Sapp and Seiler [1980], and Collins [1982], who also noted the effect of stress on budgetary attitude.

Research Limitations

The data reported here came from a questionnaire survey. Thus, the limitations usually associated with survey research apply: "halo" effect, common method measurement errors, scaling issues, nonresponse bias, and general issues of questionnaire understandability and readability. To reduce the "halo" effect, the questions (see Tables 1, 2, 3, and 4) were reordered randomly. A test of the responses indicated that no significant differences existed when the ordering of the questions was changed ($\alpha < .92$). Additionally, the responses from the budget directors (see Appendix B) provided confirmatory evidence to the responses received from the subordinates.

SUMMARY

It is likely that subordinates have different gameplay patterns of coping with their superior's budgetary leadership style and the interpersonal stress associated with budgeting. Here, we have reported the results of a study in which the game patterns (DEVIOUS, ECONOMIC, INCREMENTAL, and TIME) were found to be significantly associated with managers' attitude towards achieving their budgets, particularly when considered in the context of their superior's leadership style and the amount of role stress extant in the budgeting process. Specifically, managers who had a positive budgetary attitude were likely to use the ECONOMIC, INCREMENTAL, or TIME game pattern, were not likely to use the DEVIOUS pattern, had relatively low role stress, and had superiors who used punitive leadership styles.

APPENDIX A

GAMEPLAY PATTERNS

A factor-analytic approach was used to determine whether managers use patterns of gameplay. The existence of factors would imply that such a pattern of budgetary gameplay existed (see Kim and Mueller [1978]). We used eigenvalues > 1.0 to identify important factors in the responses to the questions in Table 3. Since we were interested in the interpretability of any existing factor patterns (rather than the interpretability of the variables [games] comprising the factors), an oblique "*R*-factor" solution was used. The use of the *R*-factor solution allows any interrelationships within the factor patterns to be better identified than does an orthogonal solution (since an orthogonal solution is based upon a rotation such that independent factors result). Since it is reasonable to expect a subordinate to use more than one game (see footnote 4 as well as Collins et al. [1983]), it is not unexpected to find that certain games load on more than one gameplay pattern. *R*-factor analysis revealed that 91 percent of the common variance in budgeting games (patterns) could be explained by four factors, as indicated in Table 11. The common variance represented 72 percent of the total variance.

TABLE 11
FACTOR LOADINGS OF BUDGET GAMES

Specific Behaviors—Games[2]	*Factors*[1] *Devious*[3]	*Economic*	*Incremental*	*Time*
1. Horatio at the bridge	0.488		−0.643	
2. Incremental change	0.601		−0.605	
3. Friendship with boss	0.453			
4. Camel's nose	0.665			
5. Crisis	0.586			
6. Sacrificial lamb	0.720			
7. Piggy back	0.751			
8. On-site visit		0.406		
9. All or nothing		−0.400		
10. Present facts		0.783		
11. It'll pay for itself		0.654		
12. Seeking other's help				−0.421
13. Waiting for right time				0.631

Variance Explained by Each Factor

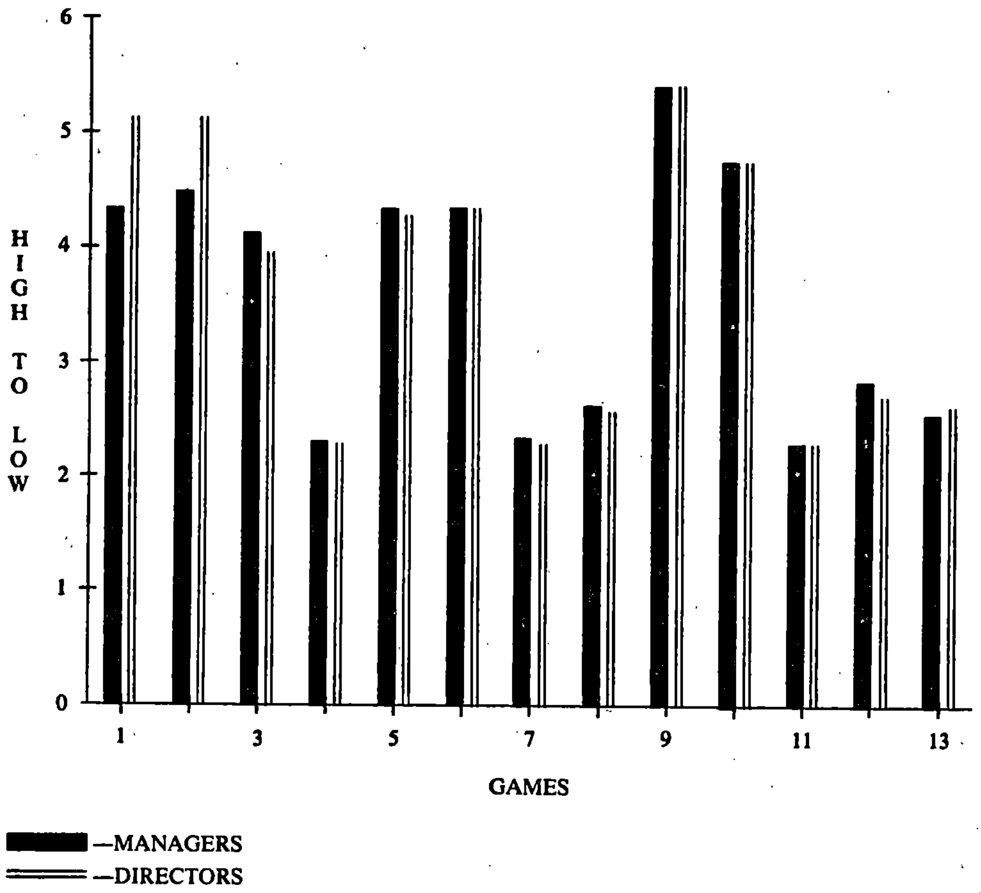
Devious	*Economic*	*Incremental*	*Time*	*Total*
3.266	1.574	1.191	1.104	7.135
41.87%	20.18%	15.27%	14.15%	91.47%[4]

[1] Oblique solution, minimum eigenvalue = 1.
[2] See Table 3 for full behavior descriptions.
[3] All loadings not depicted are ≤.32.
[4] The percentages represent the percentage of the common variance extracted from the data and captured by each factor.

Each factor in Table 11 can be identified as a budgetary gameplay pattern:

1. DEVIOUS game pattern. It involves budgeting strategies that are not straightforward. People who use this approach are likely to use the piggyback game, attach sacrificial lambs to budget packages, create a false sense of crisis, use the camel's nose game, rely on friendship with their superiors to get budgetary requests approved (the End Run game), play Horatio at the bridge, or seek only incremental budget changes.
2. ECONOMIC game pattern. People using this pattern present their superior with budget-related facts, demonstrate that requests can pay for themselves, and invite their superior to see for himself or herself how things are. This group would not assert that "they must shut down" if the budgetary request is not granted.
3. INCREMENTAL game pattern. Managers in this category use last period's amounts as a basis or starting point. They prefer to defend existing budgetary levels or seek only incremental changes in their budgetary requests.
4. TIME game pattern. This pattern is practiced by those who look for the "right time" before making budgetary requests and who do not rely on friendship with their supe-

FIGURE 3
COMPARISON OF GAMEPLAY OPINIONS



rior. Perhaps those using this pattern so distrust their superiors that they wait for circumstances to act as their chief ally.

APPENDIX B

COMPARISON OF SUBORDINATES' AND SUPERIORS' RESPONSES

As Figure 3 shows, the responses of the subordinates and the superiors to the gameplay questions were quite similar. The subordinates' responses are shown in dark bars on the chart while the superiors' responses are shown in outlined bars on the chart. The chart depicts the average responses of the two groups to the 13 budget game questions. As noted in footnote 13, a test of the responses of the two groups indicated that their response patterns were not significantly different.

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Delegated Information Gathering Decisions

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ABSTRACT: A class of agency problems is analyzed in which a principal, responsible for production decisions, delegates responsibility for gathering information germane to such decisions to an agent. At issue is the value of sample outcomes and other signals in improving the efficiency of contracts offered by the principal in resolving the moral hazard that arises from the unobservability of the agent's effort. It is shown that sample outcomes are useful in providing appropriate incentives, as well as in conditioning production decisions. *Ex post* observability of either the state of nature or the payoff from production is also shown to be valuable for incentive purposes in all but highly specialized and less interesting situations. Among the classes of agents to which these findings might apply are market researchers, political pollsters, census takers, geological surveyors, research scientists, quality inspectors, traffic monitors, talent scouts, and corporate auditors.

AGENCY theory provides a rich paradigm for examining the structure of contracts where one individual, called the principal, seeks to induce some desired behavior on the part of another individual, called the agent. A common difficulty in devising such contracts is the resolution of incentive conflicts that arise in situations where the agent's actions are not observable by the principal, and can only be inferred from imperfect signals. Often, the consequence is that the "best" contracts they can agree to are inefficient by comparison with contracts which could have been agreed to when there is no asymmetry of information concerning what action the agent selects.

In the standard agency problem, as defined by Mirrlees [1976] and elaborated on by Holmström [1979], Shavell [1979], and many others, the principal delegates responsibility for taking a productive act to the agent. It is assumed that the act along with a random state of nature determines the payoff from production and that the act involves effort on the agent's part for which he (but not the principal) incurs a direct disutility. The greater the effort, the higher the expected payoff from production. A "moral hazard" is said to exist if the principal cannot tell what action the

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agent has taken and the agent has incentive to provide less effort than he would agree to provide when his effort can be observed.

Our problem differs from the standard problem in that the principal retains the prerogative of taking the productive act, but delegates responsibility to the agent for gathering information about the state of nature prior to choosing that act. The agent is now charged with making an unobservable sampling decision such that the more he samples, the better will be the information upon which the principal conditions his productive act. Allowing that more sampling also means more effort on the agent's part, then we, too, have the moral hazard feature.

The new problem is an interesting variation of the standard problem in the sense that payoffs from production are dependent on decisions made by both the agent and the principal, and not just the former alone. Moreover, it differs from other formulations in which the agent obtains state information prior to the production decision being made (e.g., Holmström [1979], Christensen [1979] and Baiman and Evans [1983]), both because the principal makes the production decision, and because the sampling rule is now set endogenously by an agent who incurs a direct disutility for the effort involved, rather than being fixed exogenously by endowing the agent with an information system.

Similar to the standard problem, in our analysis greater effort on the agent's part ultimately has the effect of shifting the payoff distributions to the right in the sense of first-order stochastic dominance. However, an important qualitative distinction is that the ordering of payoff distributions now corresponds to the value of information which the agent provides. Such a correspondence should be of more than passing interest to accountants and others whose stock in trade is information.

Well before agency theory became popular, Feltham and Demski [1970] drew the distinction between the information supplier and the user of that information. More recently, Demski [1980] placed the incentive conflict between the two in an agency setting wherein the information decision was made by a principal who had delegated responsibility for selecting an unobservable production act to the agent. We differ in that we attach the moral hazard to the unobservability of the information choice rather than the production choice.[1] Also, in our formulation an optimal information decision is part of the solution, while in Demski's, one has to compare solutions to problems conditioned by alternative information systems.

Another perspective on the problem we address is to view it as an extension of preposterior analysis in statistical decision theory. Instead of the costs of sampling being set exogenously, these costs take the form of compensation to one individual (the agent) engaged to make the sampling decision on another individual's (the principal's) behalf. In this context, we can think of the principal as seeking to maximize the expected net gain from sampling by inducing the agent to choose the desired sampling rule through the structure of the employment contract he offers to him.

Our problem also bears similarity to those found in the literature on scoring rules (e.g., Savage [1971]). In that connection, we can view the agent as a probability assessor, i.e., someone who offers probabilities of an event (state) to other individuals who make decisions based on those probabilities.[2] However, unlike the literature on scoring rules, our focus is not on the truth-telling aspect *per se,* but rather on the moral hazard associated with the agent's effort. In the model we analyze, the information reported by the agent is costlessly verifiable. Only his effort in gathering that information is not jointly observable.

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[1] A further moral hazard may be introduced when the payoff from production, but not the principal's action, is mutually observable before settling up.

A central notion throughout is that sample information serves two purposes: it furthers production decisions by reducing uncertainty concerning the state of nature which may occur, and it improves the efficiency of contracts in resolving incentive conflicts between the parties involved. Other information, such as *ex post* observation of payoffs from production or the state of nature, may also be important to contract efficiency. The purpose of the analysis is to develop propositions on properties of (Pareto) optimal contracts which follow from differing assumptions concerning the set of signals available on which to contract, and analogously on the expected value of information.

The next section presents our analysis. A brief summary concludes the paper.

ANALYSIS

The Problem

Consider the problem of providing suitable incentives to a quality inspector, where the number of defects detected per unit of time is used to calibrate a production process. Let us further assume that both the number of defects per unit of time (effort) spent inspecting and the outcomes from production depend on a random state of nature. Ideally we would like to directly reward the inspector's effort, but that is unobservable. We can only observe the number of defects the inspector finds and the outcomes from production.

If we pay the inspector a constant wage, then there is no incentive to expend any effort. Alternatively, we could base the inspector's compensation on the number of defects found. This offers some improvement over the fixed wage in that by expending more effort the inspector increases the likelihood of finding some defects and receiving payment. However, a risk-averse inspector would never find it preferable to expend all the effort he or she would be willing to expend, since at some point the utility of additional payment for the uncertain discovery of a defect will be more than offset by the disutility of the (certain) effort involved. At least this would be true for any compensation arrangement that we would find profitable to provide.

Better yet would be to have the inspector's compensation depend on both the number of defects found and the outcomes of the production process calibrated on that information. This arrangement dominates because the outcome also depends upon the state of nature, and knowing the state of nature allows us to infer more about the effort actually expended. A third alternative, which can be no worse than observing the production outcome as well as the sample outcome, would be to observe the state of nature (*ex post*) in place of the production outcome.

The objective of the analysis is to demonstrate these points and others concerning the generic problem which this example serves to illustrate.

The Model

While we will ignore points of rigor in the analysis which follows, it should be understood that the existence and characterization of optimal solutions depend on such points. To begin, let

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[2] A simple example is a meteorologist's forecast of the chance of rain tomorrow. This information may be used in scheduling airline flights or arranging a picnic. At issue is whether the meteorologist reports his or her best estimate.

$\theta \equiv$ state of nature;
$y \equiv$ sample outcome;[3]
$Y \equiv$ information available on which to contract;
$\eta \equiv$ agent's sampling decision or effort;
$a \equiv$ principal's productive act;
$x(a,\theta) \equiv$ payoff from production;
$s(Y) \equiv$ sharing rule;
$w(s(Y),\eta) \equiv$ agent's utility function; and
$f(\theta,y|\eta) \equiv$ joint probability density function.

Some assumptions that we will use throughout include:

1. the principal is risk-neutral, acting as an expected value maximizer;
2. the agent has additively separable utility in wealth and effort:
$$w(s(Y),\eta)=u(s(Y))-v(\eta);$$
3. the agent is wealth-seeking and (strictly) risk averse:
$$u'(\omega)>0,\ u''(\omega)<0,$$
where ω denotes wealth; and
4. the agent is work-averse:
$$v'(\eta)>0.$$

The principal's problem is to select a sharing rule and production policy to maximize the expected value of payoffs from production net of the share given to the agent as incentive to expend effort. Constraints are needed to reflect the agent's opportunities to apply his efforts elsewhere (his reservation utility) and the agent's authority to make the sampling decision. More precisely, if the sharing rule is based on Y, then we have

$$\underset{s(Y),\eta}{Max} \int \underset{a}{Max} \int [x(a,\theta) - s(Y)] f(\theta,y|\eta)d\theta dy \qquad (1)$$

$$ST\colon \int\int u(s(Y))f(\theta,y|\eta)d\theta dy - v(\eta) \geq \overline{w} \qquad (2)$$

$$\eta \epsilon \underset{\eta'}{argmax} \int\int u(s(Y))f(\theta,y|\eta') d\theta dy - v(\eta') \qquad (3)$$

where $\overline{w}$ denotes the agent's reservation utility. Note that the objective function can be likened to the expected net gain from sample information, i.e., the principal's terminal utility less disutility for sampling.

By assuming, further, that

5. the agent's expected utility is twice differentiable and concave in η:[4]
$$\frac{\partial^2}{\partial\eta^2} \int\int u(s(Y))f(\theta,y|\eta)d\theta dy - v''(\eta)<0,$$

we can replace the expression in (3) with a first-order condition that is both necessary and sufficient to identify an optimal interior solution (given such a solution exists) to the agent's problem of selecting a level of effort once the sharing rule has been set:

$$\frac{\partial}{\partial\eta} \int\int u(s(Y))f(\theta,y|\eta)d\theta dy - v'(\eta)=0.$$

To proceed analytically, we also would like to say something more about the nested maximand. In particular, let us add the assumption that

6. the principal's expected utility

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[3] For ease of exposition, we use the expression "sample outcome" as a concise and intuitive analog to "information gathered by the agent."

[4] This assumption is restrictive on the form of the sharing rule. For consideration of more primitive assumptions in a standard agency context, see Lambert [1981].

given y and η is twice differentiable and concave in a:[5]

$$\frac{\partial^2}{\partial a^2}\int[x(a,\theta)-s(Y)]f(\theta,y|\eta)\,d\theta<0, \text{ for all } y,\eta.$$

Accordingly, we can define the principal's choice of a productive act conditional on a given sampling effort, sample outcome, and sharing rule as follows:

$$\frac{\partial}{\partial a}\int[x(a,\theta)-s(Y)]f(\theta,y|\eta)\,d\theta\,dy=0.$$

The principal's problem can now be restated as follows:

$$\underset{s(Y),\eta,a(y,\eta)}{Max}\ \int\int[x(a(y,\eta),\theta)-s(Y)]f(\theta,y|\eta)\,d\theta\,dy \tag{4}$$

$$ST\text{: } \int\int u(s(Y))f(\theta,y|\eta)\,d\theta\,dy-v(\eta)\geq\overline{w} \tag{5}$$

$$\frac{\partial}{\partial\eta}\int\int u(s(Y))f(\theta,y|\eta)\,d\theta\,dy-v'(\eta)=0 \tag{6}$$

$$\frac{\partial}{\partial a}\int[x(a,\theta)-s(Y)]f(\theta,y|\eta)\,d\theta=0, \text{ for all } y,\eta. \tag{7}$$

Information for Contracting

Information available on which to contract may include the sample outcome, payoff from production, and/or state of nature. Other signals could be considered; however, the problem is rich enough for our purposes without enlarging the set to include such signals. Classes of agents to which the analysis might apply include market researchers, political pollsters, census takers, geological surveyors, revenue agents, research scientists, quality inspectors, traffic monitors, and corporate auditors.

Contracting on the Sample Outcome Only. We first assume that only the sample outcome is observable before settling up. The sequence is that the principal announces the sharing rule, the agent makes the sampling decision, the agent reports the sample outcome to the principal, the principal costlessly verifies the sample outcome and compensates the agent, the principal selects the productive act, and the principal receives the payoff from production.

The principal's problem can be restated in a more convenient form by expressing the constraints given by (7) implicitly rather than explicitly. Differentiating under the integral sign, we obtain (compensation to the agent disappears)

$$\int x_a(a,\theta)f(\theta,y|\eta)\,d\theta=0, \text{ for all } y,\eta,$$

which implies a function $a(y,\eta)$ as a solution. By substitution the problem then becomes

$$\underset{s(y),\eta}{Max}\ \int\int[x(a(y,\eta),\theta)-s(y)]f(\theta,y|\eta)\,d\theta\,dy \tag{8}$$

$$ST\text{: } \int u(s(y))h(y|\eta)\,dy-v(\eta)\geq\overline{w} \tag{9}$$

$$\int u(s(y))h_\eta(y|\eta)\,dy-v'(\eta)=0, \tag{10}$$

where $h(y|\eta)\equiv\int f(\theta,y|\eta)\,d\theta$.

Note that an analogy can be made between the conditional distribution over the sample outcome, y, parameterized by the agent's action, η, and the conditional distribution over an outcome from production parameterized by an agent's action such as we would find in the standard agency problem. Moreover, fixing the production policy, $a(y,\eta)$, and integrating the objective function given by (8) with respect to θ, we obtain a problem essentially similar to the standard agency problem. In effect, suppressing the production policy choice, the expected utility of the principal depends on the agent's action only through the sample outcome. This can be likened to the standard problem wherein the expected utility of the principal depends on the agent's action only through the outcome from production.

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[5] Similar to assumption 5, this assumption may limit the class of feasible sharing rules, an issue that we do not address.

A further assumption we require is that

7. the lower bound on the support for y is nonmovable in η.

This assumption rules out the ability of the principal to exploit the agent's risk aversion by imposing a large enough penalty for an outcome not possible under a lower than agreed upon effort to drive a desired choice of η. Alternatively, we could restrict the size of penalties that could be imposed.

From the calculus of variations, the Euler condition implies the following characterization of an optimal sharing rule:

$$\frac{1}{u'(s(y))}=\lambda+\mu\frac{h_\eta(y|\eta)}{h(y|\eta)}, \text{ for all } y. \quad (11)$$

Equation (11) is the familiar pointwise condition of Mirrlees [1976] in the standard agency problem. The expression $h_\eta(y|\eta)/h(y|\eta)$ is a likelihood ratio and reflects the impact of a small change in the agent's effort on the sampling distribution.

Lastly, we assume that

8. the expected payoff from production under an optimal policy, $a(y,\eta)$, is increasing in η:

$$\frac{\partial}{\partial\eta}\int\int x(a(y,\eta),\theta)f(\theta,y|\eta)d\theta dy>0.$$

The logic for this assumption is that the more sampling the agent does, the better will be the principal's decisions with respect to choosing a productive act. In the standard problem a similar shift in the expected outcome from production is implied by an assumption of first-order stochastic dominance on the outcome distribution.

We can now state our first proposition:

Proposition 1:

> If, by knowing the sample outcome, y, the principal cannot infer the agent's decision, η, with certainty (i.e., $h(y|\eta)$ is not the indicator function), then a Pareto optimal sharing rule based on the sample outcome is strictly inferior to a Pareto optimal sharing rule based on the agent's decision.

Proof: (See Appendix)

Simply put, the agent will not expend as much effort as the principal would prefer and that the agent would be willing to expend if his actions could be observed. The principal exposes the agent to risk by making the latter's compensation depend on the uncertain sample outcome to induce effort. On the other hand, by doing so the principal must now compensate the agent for bearing that risk, thereby departing from the first-best contract which would compensate the agent only for the effort expended. This is a standard result in agency problems with moral hazard.

A special case, in which assumption 8 is met, is where the principal faces a quadratic loss function such as that defined below:

$$x(a,\theta)=-(a-\theta)^2$$

This case is representative of a wide range of problems from statistical decision theory involving the estimation of an unknown parameter (see DeGroot [1970]). It is well-known that under fairly general conditions, if y is a sufficient statistic for the outcomes of a random sample of size η from a distribution parameterized by θ, then

$$a(y,\eta)=E(\theta\,|\,y,\eta)$$

where $a(y,\eta)$ denotes an optimal (conditional) act and $E(\theta\,|\,y,\eta)$ is the posterior mean. Hence, the expected loss can be written as

$$-\int Var(\theta\,|y,\eta)h(y\,|\,\eta)dy=$$
$$-E[Var(\theta\,|y,\eta)],$$

i.e., the expected posterior variance. Since the expected posterior variance can also be written as the prior mean squared (which does not depend on η) less the expected variance of the posterior mean (which is decreasing in η), then we have the desired property that

$$-\frac{\partial}{\partial\eta}E[Var(\theta\,|y,\eta)]>0.$$

Note that in the special case the agent's effort in gathering more information translates into reduction in the risk stemming from uncertainty about the state of nature. Accordingly, one might conjecture that under appropriate circumstances a risk-averse agent might expend greater effort than would be mutually desired if his effort could be observed, rather than less effort as $\mu>0$ implies. The reason the agent always underexpends effort is that it is inefficient for the agent to choose a level of risk other than that which the principal wishes him to bear. While the principal exploits the agent's inclination to reduce risk by exposing him to risk in the form of the sharing rule, the requirement that the agent be paid a premium for bearing risk means that the principal will find it optimal to induce less than the first-best level of effort.

To illustrate, suppose the θ is distributed gamma with prior parameters both equal to unity, y is Poisson with parameters η and θ, and $u(\cdot)$ is the square-root function. In a quality control setting, θ could be interpreted as an arrival rate of defects per unit time, η as the time spent by an agent-inspector observing the process, and y as the number of defectives spotted. The likelihood ratio is then just the standardized difference between the defectives spotted and the expected number given the (optimal) time spent (i.e., $h_\eta(y\,|\,\eta)/h(y/\eta)=(y-\eta)/\eta(\eta+1)$). In turn, the sharing rule is quadratic in the standardized differences (i.e., $s(y)=(1/4)(\lambda+\mu(y-\eta)/\eta(\eta+1))^2$), and the agent's expected utility for compensation given that rule is increasing in effort. If we further assume that the agent's disutility for effort is strictly convex, say $(1/2)\eta^2$, then an interior solution to the agent's problem exists and is identified by (10).

Similar to the special case, let $x(a,\theta)$ again be defined as the quadratic loss $-(a-\theta)^2$. It can be shown that for each y the principal's optimal productive decision is to choose a equal to $(y+1)/(\eta+1)$, implying an expected loss of $1/(\eta+1)$ which is decreasing in η. Hence, μ is positive. Moreover, from (10) it follows that μ is increasing in η (i.e., $\mu=\eta^3+\eta^2$), or equivalently that it is becoming increasingly costly to induce the agent to spend more time (effort) observing the process.

Contracting on the Sample Outcome and the State of Nature. Next, we assume that the state of nature, θ, as well as the sample outcome is mutually observable before a full settling-up is achieved. In the sequence, the state is not observable by either party until after production takes place. We could also assume that the outcome from production is observable at this juncture. However, as is made apparent later on, in our model such an added signal is at best redundant, implying weak Pareto dominance for contracts based on the state alone.

While it may be uncommon for the compensation of information gatherers to be tied explicitly to an *ex post* observation of the state of nature, one can envision an implicit linkage in the form of reputation. An election result inconsistent with the findings of a poll, an unsuccessful effort in drilling for oil based on geological evidence, later discovery of fraud undetected by an audit, or an absence of rainfall counter to meteorological reports are likely to affect reputations negatively, whereas the contrapositive state realization would likely have the opposite consequence.[6]

The following proposition speaks to the value of the additional information, if any, provided by θ:

Proposition 2:

> If, and only if, by knowing θ, the principal can infer more about the agent's decision η than he could from y alone (i.e., y is not a sufficient statistic for θ with respect to η), then a Pareto optimal sharing rule based on the sample outcome y alone is strictly inferior to a Pareto optimal sharing rule based on both the sample outcome y and the state of nature θ.

Proof: (See Appendix)

Similar to Shavell [1979], the proof relies upon the principal's ability to modify the sharing rule (optimal when only y can be observed) to increase the agent's marginal expected utility for effort. Greater effort by the agent then translates into a higher expected payoff to the principal, part of which can be used to compensate the agent.

The pointwise condition on the optimal sharing rule in this case is just

$$\frac{1}{u'(s(x(a,\theta)))}=\lambda+\mu\frac{f_\eta(\theta,y\mid\eta)}{f(\theta,y\mid\eta)}. \qquad (12)$$

Decomposing the likelihood ratio in (12), we obtain

$$\frac{f_\eta(\theta,y\mid\eta)}{f(\theta,y\mid\eta)}=\frac{g_\eta(\theta\mid y,\eta)}{g(\theta\mid y,\eta)}+\frac{h_\eta(y\mid\eta)}{h(y\mid\eta)},$$

which serves to illustrate the departure of an optimal sharing rule from that characterized previously by (11).

Returning to the example wherein y is defined as the number of defectives from a Poisson process with unknown (gamma distributed) mean per unit time, θ, and elapsed time, η, the form of the sharing rule implied by (12) is similar to before except that θ replaces the posterior estimate $(y+1)/(\eta+1)$ (i.e., $s(y,\theta)=(1/4)(\lambda+\mu((y/\eta)-\theta))^2$). As before the agent's problem is well posed with (10) identifying an optimal interior solution.

Because the principal must choose his or her productive act before observing θ, the expected loss is still measured by the expected posterior variance, $1/(\eta+1)$. Accordingly, the incremental value of θ is wholly related to efficiency gains in contracting with the agent. The multiplier μ is again increasing in η. However, it is smaller for a given η (i.e., $\mu=\eta^3$ as opposed to $\mu=\eta^3+\eta^2$), implying that it is now less costly for the principal to induce greater effort.

The next issue is whether there are

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[6] Reputation, in turn, can be thought to translate into a loss or gain in expected future compensation. For example, the principal can be thought to penalize (reward) the agent, either in renewal engagements, or by communicating dissatisfaction (satisfaction) to others and deriving a "psychic" gain by doing so. Of course, proper consideration of reputation would involve a multiperiod analysis.

non-trivial situations in which θ is not informative, i.e.,

$$g(\theta|y,\eta)=g(\theta|y), \text{ for all } \theta,y.$$

From Bayes' formula, we have

$$g(\theta|y,\eta)=\frac{p(\theta)\ell(y|\theta,\eta)}{h(y|\eta)} \tag{13}$$

where $p(\theta)$ denotes the prior density over state of nature and $\ell(y|\theta,\eta)$ denotes a sample likelihood function. Equation (13), in turn, leads naturally to the next proposition.

Proposition 3:

> The sample outcome, y, is a sufficient statistic for θ with respect to η if, and only if, at least one of the following is true: y provides perfect information about η; y is distributed independently of η; and/or y is distributed independently of θ.

Proof: (See Appendix)

Note that none of the cases in which y is a sufficient statistic is very interesting. If y is distributed independently of η, then contracting on y serves no purpose, i.e., the minimal level of η is optimal. If y provides perfect information about η, then the moral hazard on the agent's part can be costlessly remedied, i.e., a first-best contract is achievable based on y alone, and, finally, if y and θ are independent, then y is of no value to the principal in conditioning the production decision, implying there is no point in engaging the agent in the first place. Thus, in any interesting case, *ex post* observation of θ would be valuable.

Continuing with the example on sampling for defectives, a number of points made above can be reinforced. In general, given nondegenerate (conditional) distributions for both y and θ, it is clear that y is not a sufficient statistic for θ with respect to η. Hence, observing θ *ex post* in addition to y is useful in providing appropriate incentives to the agent in choosing η.

If y is redefined as the length of time spent observing the process (i.e. $y=\eta$), then it is obvious that y is a sufficient statistic, and nothing further can be gained by observing θ after production has taken place. However, there is no reason for the agency to form since the principal learns nothing about θ prior to choosing his productive act. Alternatively, if y is redefined to include the time spent as well as the number of defectives, then y is useful in conditioning production decisions, as well as sufficient to induce the first-best level of effort.

Contracting on the Sample Outcome and Payoff from Production. Lastly, we assume that both the sample outcome and payoff from production are jointly observable before settling up. The sequence is the same as in the previous case except that the payoff from production in place of the state of nature is observable *ex post* and the principal compensates the agent after production takes place rather than before.

Among the many types of agents and sharing institutions for which this case might be appropriate are auditors subject to legal liability based on outcomes subsequently observed, talent scouts with agreements involving a share of profits later realized in connection with their finds, internal revenue service agents compensated *de facto* on the additional assessments based on their investigations, and scientists who retain a beneficial interest in patents that relate to their discoveries (e.g., royalty arrangements).

Observe first that the transformation of variables from θ to x can, at best, preserve information contained in the former relative to the agent's sampling decision and could result in a loss of information if it is not a one-to-one mapping.

Proposition 4:

> If the state of nature, θ, is not informative, then the payoff from production is also not informative.

Proof: (See Appendix)

The following proposition is a direct corollary of Proposition 2:

Proposition 5:

> If, by knowing the productive outcome, x, the principal can infer more about the agent's decision, η, than he could from the sample outcome, y, alone (i.e., y is not a sufficient statistic for θ with respect to η, and x is a nontrivial function of θ), then a Pareto optimal sharing rule based on the sample outcome alone is strictly inferior to a Pareto optimal sharing rule based on both the sample outcome and the payoff from production.

The intuition behind this last proposition is simply that by observing the payoff from production, for a given sample outcome and related productive act, one can reduce the posterior uncertainty with respect to the state of nature. Thus, if θ is additionally informative, then x must be as well.

Given that the sharing rule depends on x, which in turn depends on the productive act, the principal now considers the effect his or her choice will have on the compensation paid to the agent, as well as the effect on the expected payoff from production. This may be contrasted with the previous cases where the sharing rule did not depend on x, except through the agent's decision which it induced and the sample outcome which then occurred, i.e., where the principal's only concern was to select the best productive act once the pair (y,η) had been determined.

Accordingly, the problem with the sharing rule depending on the payoff from production involves a further moral hazard in that after the agent makes a sampling decision and a sample outcome is then realized, it is conceivable that the principal would prefer a different action than that which would maximize the expected payoff from production conditional on y and η.[7] If, on the other hand, the principal's action could be jointly observed, then he or she could precommit to following an optimal production policy and this moral hazard would disappear. Even in this case the analysis is difficult, since the agent will make a sampling decision with consideration of its effect on the productive act given that policy.

The pointwise condition for characterizing an optimal sharing rule with precommitment to $a(y,\eta)$, and assuming that given $a(y,\eta)$ the production function $x(a(y,\eta),\theta)$ defines a one-to-one transformation of variables, is:[8]

$$\frac{1}{u'(s(x,y))} = \lambda + \mu \frac{f_\eta(\theta,y\,|\,\eta)}{f(\theta,y\,|\,\eta)} \tag{14}$$

$$+ \mu \frac{u''(s(x,y))}{u'(s(x,y))} s_x(x,y)$$

$$x_a(a,\theta)a_\eta(y,\eta), \text{ for all } \theta,y.$$

Interpreting the third term on the right-hand side of (14), it is evident that the sharing rule further depends on the agent's (1) attitude toward risk (as measured by absolute risk aversion, $-u''/u'$ and (2) marginal share of the marginal payoff induced by marginal effort.[9] Thus, in addition to the direct effect of a change in the sampling rule, η, on beliefs concerning the state and sample outcome, the principal must also anticipate the effect that such a change could have on his or her own subsequent choice of a productive act and the added risk which that poses for the agent.

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[7] This observation does not affect the proof of Proposition 5 since the form of the additive variation implies that the principal would never benefit under the new sharing rule by departing from the production policy optimal under the old rule.

[8] If the transformation of variables is not one-to-one, then a new variable can be defined that in effect combines states, θ, for which the outcomes, x, would be the same for a given action, $a(y,n)$. The conditions given by (14) would have the same form with the (joint) density $f(\theta,y\,|\,\eta)$ replaced by a density over the new variable and y.

Note that if both the principal's productive act can be jointly observed and the production function is monotone in the state of nature (and, hence, invertible), then the problem is considerably simplified; i.e., the third term on the right-hand side of (14) disappears. This situation, as the reader will recall, is equivalent to being able to jointly observe θ.

Alternatively, we could perform the transformation of variables and express the pointwise condition with respect to (x,y) rather than (θ,y) as follows:

$$\frac{1}{u'(s(x,y))}=\lambda+\mu\frac{q_\eta(x,y\mid\eta)}{q(x,y\mid\eta)} \qquad (15)$$

Decomposing the likelihood ratio, we obtain

$$\frac{r_\eta(x\mid y,\eta)}{r(x\mid y,\eta)}+\frac{h_\eta(y\mid\eta)}{h(y\mid\eta)}$$

Here again we can observe that an additional signal, in this case x, derives value in contracting from its conditional dependence on the agent's effort in gathering information.

SUMMARY

It is natural to separate production decisions from decisions concerning the gathering of information about the state of nature upon which production may depend. Delegating responsibility for the latter to another individual may introduce a moral hazard when effort in that regard is not jointly observable. Given that the information gathered, or sample outcome, is (stochastically) related to the level of effort provided, then it may be useful as a signal for purposes of providing appropriate incentives within the compensation scheme mutually agreed upon.

The analysis employed to demonstrate the incentive value of such a signal is a modest variation of that to be found in Holmström [1979], Shavell [1979], and others. Production outcomes, in this case, depend on agent effort only through sample outcomes, the distribution of which is conditioned by that effort. Assuming that greater effort implies better information, and that better information induces better production decisions, is akin to the stochastic dominance ordering of payoff distributions in those works.

Enlarging the set of signals available for contracting purposes to include *ex post* observation of the state of nature upon which production directly depends was shown to be of value in all but a few special cases. The cases ruled out include only the less interesting situations in which sample outcomes are either inde-

[9] To better understand (14), consider what the analogous pointwise condition would be if the agent chose the productive act rather than a sampling rule:

$$\frac{1}{u'(s(x))}=\lambda+\mu\frac{v''(s(x))}{u'(s(x))}s_x(x)x_a(a,\theta).$$

The above is precisely the condition that would obtain in the standard agency problem, where the transformation of variables from states, θ, to outcomes, x, had not been made (see Amershi [1980]). Although in our original problem the agent does not choose the productive act, he does choose the sampling rule upon which that act depends.

pendent of states of nature (implying that the agency should not be formed), distributed independently of agent effort (implying that zero effort is optimal), or perfectly informative of agent effort (implying that potential moral hazard on the agent's part imposes no costs).

More realistically, the set of signals might include the outcome from production rather than the state of nature. This may introduce a further moral hazard if the production policy is not jointly observable, or if the principal cannot precommit to such a policy. Although this case does not lend itself to analysis, we were able to show that even with such a hazard present, it is generally possible to improve upon contracts based on the sample outcome alone. Moreover, by assuming that the principal can precommit to an optimal production policy we were able to demonstrate a further sensitivity of an optimal sharing rule on the agent's risk attitudes and his or her marginal product.

While developing applications was not within our primary purpose, it seems that the analysis has the potential to explain a wide variety of compensation arrangements and reporting conventions. Whether a signal is valuable or not depends on its use in conditioning production decisions and/or compensation for individuals charged with supplying the information on which that decision is based. If the information being supplied is itself fully revealing of the gatherer's effort, then there is no need of further signals for contracting purposes. However, if that information is not fully revealing of that effort, then it is almost always the case that subsequent knowledge of the state to which that information relates, or of a production payoff that depends on that state, is useful in designing a compensation scheme with desirable incentive properties.

Thus, in summary, a signal may be either "production informative" in the sense that by observing the signal the principal learns something about the state of nature which may influence his or her production choice, or "incentive informative" in the sense that the principal learns something about the agent's effort which may allow more efficient amelioration of the moral hazard problem. A signal may be valuable for purposes of conditioning production decisions, without being valuable for purposes of providing appropriate incentives to the agent to expend effort; however, the converse is not true.

Throughout our analysis we relied on the critical assumption that the sample outcome was jointly observable (or costlessly verifiable), thereby eliminating the issue of truth-telling. An obvious extension would be to relax that assumption.

APPENDIX

Proof of Proposition 1: It is well-known that if η is observable, then a dichotomous sharing rule with suitable penalties will induce a so-called "first-best" solution whereunder the moral hazard constraint given by (6) is not binding. Accordingly, the proof requires only that we show the multiplier μ to be strictly positive. Suppose $\mu \leq 0$. Then, similar to Holmström [1979], we can show that

$$s(y) \geq s_\lambda, \text{ for all } y \text{ such that } h_\eta(y \mid \eta) \leq 0, \text{ and} \tag{A1}$$

$$s(y) < s_\lambda, \text{ for all } y \text{ such that } h_\eta(y \mid \eta) > 0, \tag{A2}$$

where s_λ denotes the sharing rule (a constant) that obtains when μ is set equal to zero. The inequalities given by (A1) and (A2) imply that

$$\int s(y) h_\eta(y \mid \eta) dy \leq s_\lambda \int h_\eta(y \mid \eta) dy = 0, \tag{A3}$$

or that, under an optimal sharing rule, the agent's expected compensation is nonincreasing in η.

Differentiating the Langrangian function with respect to η yields:

$$\mu = -\frac{\partial}{\partial_\eta} \int\int [x(a(y,\eta),\theta) - s(y)] f(\theta,y \mid \eta) d\theta\, dy$$

$$\bullet \left\{ \frac{\partial^2}{\partial \eta^2} \int u(s(y)) h(y \mid \eta) dy - v''(\eta) \right\}^{-1}. \tag{A4}$$

It is evident from assumptions 5 and 8 and (A3) that the right-hand side of (A4) is positive and, hence, that $\mu > 0$, a contradiction. Q.E.D.

Proof of Proposition 2: Consider necessity first. Similar to Holmström [1979], define $s(y)$ so as to satisfy

$$u(s(y)) = \int u(s(\theta,y)) g(\theta \mid y) d\theta.$$

Multiplying both sides by $h(y \mid \eta)$ and integrating with respect to y yields:

$$\int u(s(y)) h(y \mid \eta) dy = \int\int u(s(\theta,y)) f(\theta, y \mid \eta) d\theta dy, \tag{A5}$$

where we have exploited the assumption that $g(\theta \mid y,\eta) = g(\theta \mid y)$. Hence, the agent will be as well off under $s(y)$ as under $s(\theta,y)$.

By Jensen's inequality, the concavity of $u(\bullet)$, and (A5), we know that:

$$u(\bar{s}(y)) \geq u(s(y)),$$

where

$$\bar{s}(y) \equiv \int s(\theta,y) g(\theta \mid y) d\theta.$$

The monotonicity of $u(\bullet)$, then implies

$$\bar{s}(y) \geq s(y),$$

or

$$\int s(\theta,y) g(\theta \mid y) d\theta \geq s(y).$$

Hence,

$$\int\int s(\theta,y)f(\theta,y\,|\,\eta)d\theta dy \geq \int s(y)h(y\,|\,\eta)dy,$$

implying that the expected share the principal must pay the agent to induce the same amount of effort is no greater under $s(y)$ than under $s(\theta,y)$, leaving the principal no worse off.

Now consider sufficiency. Define a new sharing rule as follows:

$$s(\theta,y) \equiv s(y) + \alpha[\theta - \bar{\theta}] + \alpha\beta$$

where

$\bar{\theta} \equiv \int \theta g(\theta\,|\,y,\hat{\eta})d\theta,$

$\hat{\eta} \equiv$ optimal agent effort given $s(y)$, and

$\alpha,\beta \equiv$ constants.

The agent's expected utility, $G(\bullet,\bullet)$, under the new rule is

$$G(\alpha,\beta) = \int\int u(s(\theta,y))f(\theta,y\,|\,\eta)d\theta dy - v(\eta). \tag{A6}$$

Differentiating (A6) with respect to α (and suppressing function arguments for economy of notation) yields

$$\frac{\partial G(\alpha,\beta)}{\partial\alpha} = \int\int u'(\theta-\bar{\theta}+\beta)fd\theta dy + [\int\int uf_\eta d\theta dy - v']\partial\eta/\partial\alpha. \tag{A7}$$

Evaluating (A7) at $\alpha=0$ and $\eta=\hat{\eta}$, and recalling the Nash constraint, implies

$$\frac{\partial G(\alpha,\beta)}{\partial\alpha} = \beta\int u'(s(y))h(y\,|\,\eta)dy > 0, \text{ for } \beta > 0,$$

where the inequality follows from the assumption that $u'(\bullet) > 0$. Thus, a small positive α will make the agent better off.

The principal's expected utility, $H(\bullet,\bullet)$, under the new sharing rule is

$$H(\alpha,\beta) = \int\int[x(a,\theta) - s(y) - \alpha(\theta-\bar{\theta}) - \alpha\beta]f(\theta,y\,|\,\eta)d\theta dy. \tag{A8}$$

Differentiating (A8) with respect to α yields

$$\frac{\partial H(\alpha,\beta)}{\partial\alpha} = -\int\int(\theta-\bar{\theta}+\beta)fd\theta dy + \int\int[x-(s+\alpha(\theta-\bar{\theta}+\beta))]f_\eta d\theta dy\bullet\partial\eta/\partial\alpha. \tag{A9}$$

Evaluating (A9) at $\alpha=0$, $\eta=\hat{\eta}$, results in

$$\frac{\partial H(\alpha,\beta)}{\partial\alpha} = -\beta + \int\int[x(a(y),\theta) - s(y)]f_\eta(\theta,y\,|\,\eta)d\theta dy\bullet\partial\eta/\partial\alpha. \tag{A10}$$

Equation (A10) can be rewritten as

$$\frac{\partial H(\alpha,\beta)}{\partial\alpha} = -\beta + K\bullet\partial\eta/\partial\alpha, \tag{A11}$$

where $K \equiv \int\int [x(a,\theta)-s(y)]f_\eta(\theta,y|\eta)d\theta dy$. Since it is already known that $K>0$, then the principal can be made better off if, and only if, $-\beta+K\cdot\partial\eta/\partial\alpha>0$.

To determine $\partial\eta/\partial\alpha$, i.e., how the agent's optimal choice of η is changing with a small change in α, consider the Nash constraint

$$\frac{\partial G(\alpha,\beta)}{\partial\eta} = \int\int u(s(y)+\alpha(\theta-\bar{\theta})+\alpha\beta)f_\eta(\theta,y|\eta)d\theta dy - v'(\eta)=0. \tag{A12}$$

Differentiating (A12) with respect to α, evaluating at $\alpha=0$ and $\eta=\hat{\eta}$, and simplifying, yields

$$\begin{aligned}&\int\int(\theta-\bar{\theta})g_\eta(\theta|y,\eta)d\theta u'(s(y))h(y|\eta)dy+\beta\int u'(s(y))h_\eta(y|\eta)dy\\&\quad+[\int u(s(y))h_{\eta\eta}(y|\eta)dy-v''(\eta)]\partial\eta/\partial\alpha=0.\end{aligned}$$

Hence,

$$\frac{\partial\eta}{\partial\alpha}=\frac{Z_1+\beta Z_2}{Z_3}, \tag{A13}$$

where

$Z_1 \equiv \int\int(\theta-\bar{\theta})g_\eta(\theta|y,\eta)d\theta u'(s(y))h(y|\eta)dy$,
$Z_2 \equiv \int u'(s(y))h_\eta(y|\eta)dy$, and
$Z_3 \equiv -[u(s(y))h_{\eta\eta}(y|\eta)dy-v''(\eta)]$.

Substituting from (A13) into (A11), we obtain the following conditions for which the choice of β must satisfy $s(\theta,y)$ to be Pareto preferred to $s(y)$:

$$-\beta+K\frac{Z_1+\beta Z_2}{Z_3}>0,\ \beta>0.$$

As will be shown later, $KZ_2/Z_3-1<0$; hence the conditions on β become

$$-\frac{KZ_1/Z_3}{KZ_2/Z_3-1}>\beta>0.$$

Clearly such a β exists provided

$$KZ_1/Z_3>0.$$

If $Z_1 1>0$, then we are done (except to show $KZ_2/Z_3-1<0$). On the other hand, if $Z_1<0$, then all we need do is interchange θ and $\bar{\theta}$ and start over.

All that remains is to show that $KZ_2/Z_3-1<0$, and that $Z_1\neq0$. The necessary conditions for $(s(y),\hat{\eta})$ to be optimal are

$$\frac{1}{u'(s(y))}=\lambda+\frac{h_\eta(y|\eta)}{h(y|\eta)} \tag{A14}$$

and

$$\int\int x(a,\theta)f_\eta(\theta,y\,|\,\eta)\,d\theta\,dy=-[\int u(s(y))h_{\eta\eta}(y\,|\,\eta)\,dy-v''(\eta)].$$

Thus,

$$\begin{aligned} KZ_2/Z_3&=Z_2\\ &=\mu\int u'(s(y))h_\eta(y\,|\,\eta)\,dy\\ &=1-\lambda\int u'(s(y))h(y\,|\,\eta)\,dy, \end{aligned}$$

where deriving the last equality involved rearranging (A14) and integrating over y. Since $\lambda>0$, then

$$KZ_2/Z_3-1=-\lambda\int u'(s(y))h(y\,|\,\eta)\,dy<0.$$

Finally, the condition $z_1\neq 0$ follows immediately from the assumption that θ is additionally informative. Q.E.D.

Proof of Proposition 3: The following is taken as given

$$g(\theta\,|\,y,\eta)=\frac{p(\theta)\ell(y\,|\,\theta,\eta)}{h(y\,|\,\eta)} \tag{A15}$$

Consider sufficiency first. From (A15) it is evident that, for almost every y and θ:

condition 1 implies

$g(\theta\,|\,y,\eta)=p(\theta)$;

condition 2 implies

$g(\theta\,|\,y,\eta)=p(\theta)\ell(y\,|\,\theta)/h(y)$; and

condition 3 implies

$g(\theta\,|\,y,\eta)=p(\theta)$.

For necessity, assume that conditions 1 and 2 do *not* hold for some y and θ: i.e., the distribution of y given η is not degenerate and the distribution of y is not independent of η. For $g(\theta\,|\,y,\eta)=g(\theta\,|\,y)$, it must be the case that $\ell(y\,|\,\theta,\eta)=h(y\,|\,\eta)$, or equivalently that condition 3 does hold. Q.E.D.

Proof of Proposition 4: If the proposition holds for the case where the production function $x(a(y,\eta),\theta)$ given $a(y,\eta)$ is a one-to-one mapping from the state space to the payoff space, then clearly it is true. Hence, assume that $x(\bullet,\theta)$ is one-to-one.

Suppose θ is not informative, but x is. Let $q(x,y\,|\,\eta)$ denote the joint density function induced from the production $x(a)y,\eta),\theta)$, decision rule $a(y,\eta)$, and joint density function $f(\theta,y\,|\,\eta)$. We can then write

$$q(x,y\,|\,\eta)=r(x\,|\,y,\eta)h(y\,|\,\eta).$$

By assumption, for all η,

$r(x\,|\,y,\eta)=r(x\,|\,y)$ for almost every (x,y) is true, and

$g(\theta|y,\eta)=g(\theta|y)$ for almost every (θ,y) is false.

However, the invertibility of the production function implies

$$r(x|y,\eta)=\begin{cases} g(\theta(x)|y,\eta)\left|\dfrac{d\theta(x)}{dx}\right|, & x\epsilon R \\ 0, \text{ otherwise,} & \end{cases}$$

where $\theta(\bullet)$ is the inverse of the production function, which clearly cannot be. Hence, we have a contradiction. Q.E.D.

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A Reciprocal Service Cost Approximation

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ABSTRACT: This study proposes a new method for approximating service department costs when reciprocal services exist. Analytical results are provided demonstrating that, under certain conditions, the method produces approximations that converge to allocations under the theoretically correct reciprocal method. Numerical results are provided demonstrating that the proposed method is more accurate than the two simplified allocation procedures, the direct and step methods, even when nontrivial parameter estimation errors are assumed. These results, based on sample statistics for hypothetical firm data, suggest that many real-world firms may be able to use the proposed method to make more accurate marginal cost assessments and, therefore, to improve their service-related operating decisions.

For firms with service departments that provide reciprocal services with linear variable costs, only the reciprocal method correctly accounts for reciprocal service activities and permits a correct determination of marginal service costs. In particular, under the reciprocal method, the reallocated variable service cost for a given service department, averaged over its service output, gives the marginal cost to that department of providing an additional unit of service [Kaplan, 1973]. The reciprocal method therefore provides allocations that are useful for decision-making purposes.

In spite of this, however, the reciprocal method does not seem to be in widespread practical use. The direct method, which does not allocate any service costs among service departments, or the step method, which allocates only some of these costs, are used instead. Although the reasons why firms use these simplified procedures in place of the reciprocal method have not been carefully examined or explained in the cost allocation literature, they presumably reflect rational firm response to practical considerations. As expressed by Dopuch, Birnberg and Demski [1984, p. 348]:

> The proper allocation can be readily ascertained in a textbook, but real world complexities typically require a more simplified approach. We stop short of implementing the "perfect" allocation . . .

But regardless of how a firm justifies the use of a simplified method, it cannot use the resulting allocations to accurately or correctly determine its marginal service costs, and as a result, the quality of its service-related operating decisions may be adversely affected. Thus, these firms may have an incentive to improve the accuracy of their marginal cost assess-

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ments beyond what is possible solely from the use of simplified service allocations.

This paper presents a simple method for approximating reciprocal service costs which will permit a firm to achieve such an increase in accuracy. The method involves adjusting the traceable costs of each service department by an amount that depends on the total service consumption by the department. We show that under specified conditions, the resulting approximations converge to the firm's reciprocal service costs. As a result, the method has the potential of producing approximations that are quite close, if not identical, to allocations from the reciprocal method.

The organization of the paper is as follows. In the next section, the method is described and an underlying rationale is provided. Then a numerical procedure is used to compare the relative accuracy of the method to the corresponding accuracy of direct and step allocations in approximating reciprocal service costs. A summary concludes the paper.

THE APPROXIMATION

Reciprocal Costs

For a firm with n service departments, let $b=[b_i]_{n\times 1}$ be an $n\times 1$ vector where b_i is the traceable cost in service department i. Let $A=[a_{ij}]_{n\times n}$ be an $n\times n$ matrix where a_{ij} is the proportion of service department j's output provided to service department i. Then, under the reciprocal method, the reallocated service costs (hereafter called reciprocal costs) for the firm's service departments, denoted by an $n\times 1$ vector $x=[x_i]_{n\times 1}$, are defined as follows:

$$x=(I-A)^{-1}b \qquad (1)$$

where I is an $n\times n$ identity matrix. Since the paper focuses on marginal service costs, we assume that the traceable costs in b are entirely variable. Following Kaplan [1973], this implies that the reciprocal cost for service department i, x_i, averaged over its output, is the marginal service cost for department i.

Approximation Defined

The proposed approximation of x, denoted by the $n\times 1$ vector $\hat{x}=[\hat{x}_i]_{n\times 1}$, is defined as follows:

$$\hat{x}=b+\lambda\cdot r, \qquad (2)$$

where

$$r=[r_i]_{n\times 1} \qquad \text{where } r_i=\sum_j a_{ij}=i\text{th row-sum of } A,$$

$$\lambda=\beta/(1-\alpha),$$

$$\alpha=(1/n)\sum_i r_i \ =\text{average row-sum in } A\text{, and}$$

$$\beta=(1/n)\sum_i b_i \ =\text{average traceable cost in } b.$$

Thus, for department i, the approximation is obtained by increasing the department's traceable cost b_i by an amount equal to λr_i. It is therefore an increasing function of department i's aggregate service consumption as measured by r_i. The rationale for this approximation is explained after first discussing its accuracy. A numerical example is presented in Exhibit 1.

EXHIBIT 1

NUMERICAL EXAMPLE*

$$A=\begin{bmatrix} .05 & .15 & .15 \\ .10 & .10 & .15 \\ .20 & .20 & .05 \end{bmatrix} \qquad b=\begin{bmatrix} 30000 \\ 60000 \\ 40000 \end{bmatrix}$$

Reciprocal Method

$$x=(I-A)^{-1}b=\begin{bmatrix} 1.1225 & .2347 & .2143 \\ .1701 & 1.1871 & .2143 \\ .2721 & .2993 & 1.1429 \end{bmatrix}\begin{bmatrix} 30000 \\ 60000 \\ 40000 \end{bmatrix}\begin{matrix} = \\ = \\ = \end{matrix}\begin{bmatrix} 56329 \\ 84901 \\ 71837 \end{bmatrix} \tag{1}$$

Approximation Method

$$\hat{x}=b+\lambda\bullet r=\begin{bmatrix} 30000 \\ 60000 \\ 40000 \end{bmatrix}+70270\begin{bmatrix} .35 \\ .35 \\ .45 \end{bmatrix}\begin{matrix} = \\ = \\ = \end{matrix}\begin{bmatrix} 54595 \\ 84595 \\ 71622 \end{bmatrix} \tag{2}$$

where

$$r=\begin{bmatrix} \sum_j a_{ij} \end{bmatrix}_{n\times 1}=\begin{bmatrix} .05+.15+.15 \\ .10+.10+.15 \\ .20+.20+.05 \end{bmatrix}=\begin{bmatrix} .35 \\ .35 \\ .45 \end{bmatrix}$$

$$\lambda=\beta/(1-\alpha)=43333/(1-.383)=70270$$

$$\alpha=(1/n)\sum_i r_i=(1/3)(.35+.35+.45)=.383$$

$$\beta=(1/n)\sum_i b_i=(1/3)(30000+60000+40000)=43333$$

Approximation Errors

$$e^{\hat{x}}=x-\hat{x}=(H-I)\Delta b+\lambda\bullet(H-I)\Delta r \tag{3}$$

$$=\begin{bmatrix} .1225 & .2347 & .2143 \\ .1701 & .1871 & .2143 \\ .2721 & .2993 & .1429 \end{bmatrix}\begin{bmatrix} -13333 \\ +16667 \\ -\ 3333 \end{bmatrix}+70270\begin{bmatrix} .1225 & .2347 & .2143 \\ .1701 & .1871 & .2143 \\ .2721 & .2993 & .1429 \end{bmatrix}\begin{bmatrix} -.033 \\ -.033 \\ +.067 \end{bmatrix}$$

$$=\begin{bmatrix} 1734 \\ 306 \\ 215 \end{bmatrix}$$

where

$$\Delta b=[b_i-\beta]_{n\times 1}=\begin{bmatrix} 30000-43333 \\ 60000-43333 \\ 40000-43333 \end{bmatrix}=\begin{bmatrix} -13333 \\ +16667 \\ -\ 3333 \end{bmatrix}$$

$$\Delta r=[r_i-\alpha]=\begin{bmatrix} .35-.383 \\ .35-.383 \\ .45-.383 \end{bmatrix}=\begin{bmatrix} -.033 \\ -.033 \\ +.067 \end{bmatrix}$$

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* Problem 5, Chapter 11, Kaplan [1982], p. 377.

Approximation Errors

The accuracy of the approximations will, in general, depend on how homogeneous the firm's service departments are with respect to the traceable costs in b and row-sums in r. This is revealed by the following error function (see Appendix A):

$$e^{\hat{x}}=(H-I)\Delta b+\lambda\cdot(H-I)\Delta r, \tag{3}$$

where

$e^{\hat{x}}=[e^{\hat{x}}]_{n\times 1}$ where $e^{\hat{x}}=x_i-\hat{x}_i=$the approximation error for department i,
$H=(I-A)^{-1}$,
$\Delta b=[\Delta b_i]_{n\times 1}$ where $\Delta b_i=b_i-\beta$, and
$\Delta r=[\Delta r_i]_{n\times 1}$ where $\Delta r_i=r_i-\alpha$.

This function indicates that the approximation error for each service department converges to zero as the $n\times 1$ deviation vectors Δb and Δr both converge to $\underline{0}=[0]_{n\times 1}$ (the null vector), or as the firm becomes homogeneous in b and r. (The error computation is illustrated for the numerical example in Exhibit 1.)

Note that this convergence occurs for any number of service departments n and for any values of the service parameters α and β. Also note that the convergence of Δr to $\underline{0}$ does not imply convergence of the individual a_{ij} elements of the service matrix A. Thus, in the limiting condition when the firm is completely homogeneous in b and r and the approximation is perfect, a firm can still be heterogeneous in its reciprocal service interactions.

Given the importance of the homogeneity variables Δb and Δr, they are used later as a basis for examining the relative accuracy of the proposed approximation.

An Intuitive Explanation

The proposed approximation can be understood more intuitively by reformulating the definition in (2) for department i (see Appendix B):

$$\hat{x}_i=\lambda+(\Delta b_i+\lambda\Delta r_i) \tag{4}$$

Under this reformulation, the approximation can be viewed as a procedure of first using λ to approximate the firm's average reciprocal cost, $\bar{x}=(1/n)\sum_i x_i$, and then using $(\Delta b_i+\lambda\Delta r_i)$ as an adjustment to reflect the individual service department's variations, $\Delta x_i=x_i-\bar{x}$, around $\bar{x}$.

This interpretation is based on the following two relationships (see Appendix C):

$$\bar{x}=\lambda+(1/n)\sum_i m_i \tag{5a}$$

$$\Delta x_i=m_i-(1/n)\sum_i m_i \tag{5b}$$

where

$m_i=$the ith element in m
$=[m_i]_{n\times 1}$
$=H(\Delta b+\lambda\cdot\Delta r)$.

From these relationships, it can be seen that as the two deviation vectors Δb and Δr converge to $\underline{0}$, the terms m_i and hence Δx_i converge to zero and $\bar{x}$ approaches λ. This, in turn, implies that under the conditions for which the approximation errors converge to zero, the approximation's accuracy improves because:

1. The firm's reciprocal costs become more homogeneous (since $\Delta x_i\rightarrow 0$),

and therefore, the firm's average reciprocal cost, $\bar{x}$, becomes more representative of these costs and a more desirable target for an approximation.

2. The accuracy of λ in approximating this average, $\bar{x}$, improves (since $m_i \rightarrow 0$).
3. The accuracy of the adjustment of λ, $(\Delta b_i + \lambda \Delta r_i)$, improves (since Δb_i, Δr_i, and $\Delta x_i \rightarrow 0$).

Taken together, these three results indicate more clearly how the approximation works and the conditions under which it becomes effective.[1]

Parameter Requirements

To use the approximation, it is necessary to determine both α and β (to compute λ), and also the row-sums r_i of the interaction matrix A. It is assumed that most firms routinely record traceable service costs and can thus easily compute β. It is also assumed that many firms can readily determine A and, therefore, can easily compute α and r. The basis for this assumption is that A is a direct function of the underlying reciprocal input-output relationships among a firm's service departments, and knowledge of these relationships is necessary to effectively plan and control service activities. This assumption is even more valid for firms using the step method since at least half of the A matrix must be known to implement this method.

Firms for which A is not readily available will have to estimate α and r. It might be argued that these variables represent important aspects of a firm's service activities and can be estimated with reasonable accuracy; but without complete knowledge of A, the possibility of errors exists.

To recognize this possibility in evaluating the accuracy of the approximation, approximation errors were measured by first assuming complete knowledge of A and perfect estimation of α and r, and then by assuming only partial (or no) knowledge of A and allowing for estimation errors for both α and r.

APPROXIMATION ACCURACY

The relative accuracy of the approximation was evaluated by comparing it to the accuracy of direct and step allocations in approximating reciprocal service costs. The purpose of the comparison was to measure both the accuracy of allocation data available to firms using either the direct or step methods and the marginal improvement in this accuracy from using the proposed approximation.

Method

To make the comparisons, the following approximation errors were defined for the direct and step methods:

$$e_i^{dm} = x_i - b_i \text{ and}$$

$$e_i^{sm} = x_i - x_i^{sm},$$

where x_i^{sm} denotes the allocation to service department i using the step method (*sm*). The order of step allocations was based on the relative proportions of services provided to other service departments. These errors were compared to the approximation errors defined in (2), $e_i^{\hat{x}}$, at the firm level using both average and maximum measures:

$$\bar{e}(K) = (1/n) \sum_i (|e_i^K| / x_i) \text{ and}$$

$$e^*(K) = \max_i (|e_i^K| / x_i),$$

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[1] Given the $\bar{x}$ interpretation of λ, there is a second way to view the approximation. Returning to the original definition in (2), the λr_i term can be re-expressed as the product $(\lambda n)(r_i/n)$, where λn represents an approximation of the firm's total reciprocal costs $(=\bar{x}n)$ and r_i/n is the relative proportion of total reciprocal service output (i.e., the service output going only to service departments) consumed by department i. Under this formulation, then, the approximation for department i is the result of adding to the department's traceable cost b_i a

where $K=\hat{x}$, and *dm* and *sm* denote, respectively, the proposed approximation and the direct and step allocation methods. Absolute errors ($|e_i^K|$) were used because both positive and negative errors are undesirable. The errors were normalized by reciprocal service costs to facilitate comparisons across firms with different reciprocal cost levels.

Using the error results of the previous section, which show that the accuracy of $\hat{x}_i$ in approximating x_i depends on the homogeneity of the deviation vectors Δb and Δr, the error comparisons were made by varying these vectors with respect to their homogeneity, while at the same time controlling for the service parameters α, β, and n. To vary Δb and Δr, the following scalar measures of their homogeneity were used:

$$u^* = (\max_i |\Delta r_i|)/\alpha \text{ and}$$

$$v^* = (\max_i |\Delta b_i|)/\beta$$

The smaller the values of u^* and v^*, the closer Δr and Δb are to the null vector $\underline{0}$. In turn, from the error function in (3), $e^{\hat{x}}$ will approach $\underline{0}$, as will the average and maximum error measures $\overline{e}(\hat{x})$ and $e^*(\hat{x})$.

Data Generation

For each set of values selected for the two homogeneity variables u^* and v^*, and the three service parameters α, β, and n, a sample of hypothetical firms was generated. Each firm was represented by an (A, b) pair comprised of the following: (1) a randomly drawn $n \times n$ A matrix with a row-sum average equal to α and a maximum row-sum deviation consistent with u^*, and (2) a randomly drawn $n \times 1$ b vector with a cost average equal to β and a maximum cost deviation consistent with v^*. Thus, each firm in a given sample was allowed to have different elements in A and/or b as long as the constraints implied by the particular values of the variable/parameter set (u^*, v^*, α, β, n) were satisfied.

Only a part of the variable/parameter domain could be feasibly examined or sampled because of its overall size. The specific ranges of this domain are as follows:[2]

$$u^*, v^*: [0, n-1], \alpha: (0,1), \beta: (0, \infty), n: [2, \infty]$$

In selecting the specific values from these ranges, the objective was to choose realistic or plausible values and sample enough of the ranges to reveal general trends. Accordingly, two values of α—.2 and .5—and two values of n—4 and 8—were selected, assuming that very few real-world firms would have service departments consuming, on average, much more than half of the firm's total service output and/or many more than eight service departments. Since β acts only as a scale factor, \$100,000 was arbitrarily selected for all comparisons.

Three values of u^*—.4, 1.2, and 2—and two values of v^*—1 and 2—were selected, assuming that very few real-world firms would have u^* and v^* values much above two. This assumption was based on an inspection of A matrices and b vectors over the ranges of u^* and v^*. To illustrate, a representative sample of such matrices and vectors is presented in Exhibit 2 for $\alpha=.2$, $n=4$, and $u^*=v^*=.4$, 1.2, 2, 2.4, and 2.8. Note that for A matrices with a u^* of 2.4 and 2.8, the dominant department receives such a large proportion of services that very little (if any) reciprocal service or inter-

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specified portion (r_i/n) of the firm's approximated total reciprocal costs (λn), based on the department's relative total service consumption.

[2] The upper bound on u^* is $n-1$ because the sum of the row-sums must equal $n\alpha$, and if u^* is greater than $n-1$, the largest row-sum would be greater than $n\alpha$. The same reasoning holds for v^*.

EXHIBIT 2

ILLUSTRATIVE A MATRICES AND b VECTORS FOR SELECTED VALUES OF u^* and v^* (ASSUMING $n=4$, $\alpha=.2$ AND $\beta=\$100,000$)

Matrices

$(u^*=.4)$ — *Row Sums*

$$A=\begin{bmatrix} .05 & .07 & .05 & .11 \\ .09 & .04 & .00 & .06 \\ .06 & .07 & .02 & .03 \\ .05 & .05 & .03 & .02 \end{bmatrix} \qquad \begin{matrix} .28 \\ .19 \\ .18 \\ .15 \end{matrix}$$

$(u^*=1.2)$

$$A=\begin{bmatrix} .11 & .16 & .01 & .16 \\ .03 & .04 & .02 & .06 \\ .04 & .02 & .05 & .01 \\ .03 & .02 & .01 & .03 \end{bmatrix} \qquad \begin{matrix} .44 \\ .15 \\ .12 \\ .09 \end{matrix}$$

$(u^*=2.0)$

$$A=\begin{bmatrix} .06 & .16 & .07 & .31 \\ .02 & .02 & .01 & .02 \\ .01 & .02 & .03 & .01 \\ .02 & .02 & .01 & .01 \end{bmatrix} \qquad \begin{matrix} .60 \\ .07 \\ .07 \\ .06 \end{matrix}$$

$(u^*=2.4)$ — *Row Sums*

$$A=\begin{bmatrix} .13 & .24 & .14 & .17 \\ .02 & .01 & .00 & .02 \\ .02 & .01 & .01 & .00 \\ .01 & .01 & 00 & .01 \end{bmatrix} \qquad \begin{matrix} .68 \\ .05 \\ .04 \\ .03 \end{matrix}$$

$(u^*=2.8)$

$$A=\begin{bmatrix} .17 & .22 & .25 & .12 \\ .01 & .00 & .00 & .01 \\ .00 & .01 & .00 & .00 \\ .00 & .00 & .01 & .00 \end{bmatrix} \qquad \begin{matrix} .76 \\ .02 \\ .01 \\ .01 \end{matrix}$$

Cost Vectors

$(v^*=.4)$ $\quad$ $(v^*=1.2)$ $\quad$ $(v^*=2.0)$ $\quad$ $(v^*=2.4)$ $\quad$ $(v^*=2.8)$

$$b=\begin{bmatrix} 140000 \\ 120000 \\ 83000 \\ 57000 \end{bmatrix} \quad b=\begin{bmatrix} 220000 \\ 112000 \\ 58000 \\ 10000 \end{bmatrix} \quad b=\begin{bmatrix} 300000 \\ 56000 \\ 29000 \\ 15000 \end{bmatrix} \quad b=\begin{bmatrix} 340000 \\ 25000 \\ 21000 \\ 14000 \end{bmatrix} \quad b=\begin{bmatrix} 380000 \\ 9000 \\ 8000 \\ 3000 \end{bmatrix}$$

Note: To facilitate comparisons, the rows of A are shown in the order of descending row-sums, and similarly, the elements in b are shown in the order of descending costs.

action occurs among the other service departments. Also, for b vectors with v^* values of 2.4 and 2.8, the dominant department has costs that are, respectively, 17(=\$340000/\$20000) and 57 (=\$380000/\$6667) times the average cost of all the remaining departments. It would seem that firms with A matrices and b vectors reflecting these types of service characteristics are not realistic.

These variable/parameter value selections resulted in 24 combinations ($3\times 2\times 2\times 1\times 2$) of (u^*,v^*,α,β,n). For each combination, a random sample of 40C firms (A,b pairs) was generated and the sample mean and standard deviation fo the average and maximum error measures, $\bar{e}(K)$ and $e^*(K)$, were computed.[3]

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[3] In a preliminary data analysis, relatively large sampl standard deviations were observed for some of the erro estimates. It was found that this was due to extremel large approximation errors for individual service depart ments with very small direct costs and very small row sums. To remedy this problem, sample firms were con strained to have no departments with a cost or row-sur below ten percent of the largest cost or row-sum depar ment, respectively. It was felt that any resulting loss i

As discussed earlier, errors may occur in estimating α and/or the row-sums in r when using the proposed approximation. To determine the effects of such errors, the sampling procedure was modified in the following way. For each firm in the modified sample, the A matrix was generated based on values of α and row-sums r_i, randomly drawn from the intervals:

$$\hat{\alpha} \pm (\hat{\alpha} \times W) \text{ and } \hat{r}_i \pm (\hat{r}_i \times W)$$

where $\hat{\alpha}$ and $\hat{r}_i$ represent, respectively, a firm's estimates of α and r_i, and where W represents a maximum possible error rate. For $W = .1$, $.2$, $.3$, $.4$, and $.5$, a revised set of estimates of $\bar{e}(\hat{x})$ and $e^*(\hat{x})$ were computed and compared to the corresponding direct and step error measures.

Results

Tables 1 and 2 contain the sample data for average and maximum firm errors under the direct method, step method, and proposed approximation with no α and r estimation errors, and with α and r estimation errors of up to 30 percent and 50 percent (to save space, results for the ten, 20, and 40 percent cases were omitted). The first number in each cell is the sample mean for the average (or maximum) error; the second number is the sample standard deviation.

For all variable/parameter combinations examined, the proposed approximation outperforms both the step and direct methods in approximating reciprocal costs. This occurs for both average firm and maximum firm errors, and with one exception, for estimation errors of up to 50 percent. For most of the cases, the standard deviations are small enough to permit reliable comparisons of sample means. The exceptions occur for certain variable/parameter combinations when comparing the step method to the proposed approximation with maximum estimation errors of 50 percent.

The ranges of the error differences are presented below:

Error Measure	*Maximum Est. Error*	*(Step-Approx.)*		*(Direct-Approx.)*	
		Low	*High*	*Low*	*High*
Average	0%	6%	30%	17%	50%
	30	4	24	15	43
	50	2	18	14	37
Maximum	0%	4%	52%	32%	68%
	30	1	38	30	55
	50	-4	23	25	39

The data in Tables 1 and 2 indicate that the accuracy of the proposed approximation relative to the direct and step methods increases as the firm becomes more homogeneous in its row sums (as measured by u^*), and is relatively unaffected by its traceable cost homogeneity (as measured by v^*). With respect to the service-related parameters α and n, the relative accuracy of the pro-

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generalizability to firms that violate this constraint was justified by the more reliable sample means (i.e., smaller standard deviations) for firms that do not.

TABLE 1

AVERAGE APPROXIMATION ERRORS ($\bar{e}(K)$)

			$v^*=1$					$v^*=2$				
			Proposed Approximation					*Proposed Approximation*				
			Max. Estimation Error					*Max. Estimation Error*				
n	α	u^*	*0%*	*30%*	*50%*	*Step Method*	*Direct Method*	*0%*	*30%*	*50%*	*Step Method*	*Direct Method*
4	.20	0.4	.04 (.02)	.05 (.02)	.07 (.03)	.14 (.04)	.25 (.03)	.09 (.04)	.10 (.04)	.13 (.05)	.18 (.06)	.33 (.04)
		1.2	.03 (.02)	.05 (.02)	.07 (.03)	.12 (.03)	.23 (.03)	.08 (.04)	.09 (.04)	.11 (.05)	.16 (.05)	.30 (.04)
		2.0	.03 (.02)	.05 (.02)	.06 (.03)	.10 (.03)	.20 (.03)	.07 (.04)	.09 (.05)	.11 (.06)	.13 (.04)	.25 (.05)
4	.50	0.4	.06 (.03)	.12 (.06)	.19 (.08)	.36 (.05)	.53 (.03)	.14 (.08)	.19 (.10)	.26 (.14)	.40 (.09)	.61 (.04)
		1.2	.08 (.05)	.13 (.07)	.19 (.09)	.33 (.06)	.49 (.04)	.14 (.09)	.18 (.10)	.25 (.13)	.38 (.09)	.56 (.05)
		2.0	.10 (.07)	.14 (.08)	.18 (.10)	.30 (.08)	.43 (.06)	.15 (.10)	.19 (.13)	.25 (.14)	.36 (.10)	.50 (.07)
8	.20	0.4	.02 (.01)	.04 (.01)	.06 (.02)	.12 (.02)	.24 (.02)	.03 (.01)	.05 (.01)	.07 (.02)	.13 (.03)	.25 (.01)
		1.2	.02 (.01)	.04 (.01)	.06 (.02)	.12 (.02)	.23 (.02)	.03 (.01)	.05 (.01)	.07 (.02)	.12 (.02)	.24 (.02)
		2.0	.02 (.01)	.04 (.01)	.06 (.02)	.12 (.02)	.22 (.02)	.03 (.01)	.04 (.01)	.07 (.02)	.12 (.02)	.23 (.02)
8	.50	0.4	.03 (.01)	.10 (.03)	.16 (.04)	.33 (.03)	.53 (.01)	.05 (.02)	.11 (.03)	.17 (.05)	.35 (.04)	.54 (.02)
		1.2	.04 (.02)	.09 (.03)	.16 (.05)	.31 (.03)	.50 (.02)	.05 (.02)	.10 (.03)	.17 (.06)	.32 (.04)	.51 (.02)
		2.0	.05 (.02)	.10 (.03)	.16 (.05)	.31 (.04)	.48 (.02)	.06 (.03)	.11 (.04)	.17 (.06)	.33 (.04)	.50 (.03)

Note: The first number in each cell is the sample mean of $\bar{e}(K)$; the second number (in parentheses) is its standard deviation.

TABLE 2
MAXIMUM APPROXIMATION ERRORS ($e^*(K)$)

			$v^*=1$					$v^*=2$				
			Approximation					*Approximation*				
			Max. Estimation Error					*Max. Estimation Error*				
n	α	u^*	*0%*	*30%*	*50%*	*Step Method*	*Direct Method*	*0%*	*30%*	*50%*	*Step Method*	*Direct Method*
4	.20	0.4	.08 (.05)	.11 (.05)	.15 (.07)	.26 (.11)	.41 (.09)	.18 (.08)	.21 (.10)	.26 (.11)	.35 (.13)	.50 (.07)
		1.2	.08 (.05)	.12 (.07)	.17 (.09)	.22 (.08)	.44 (.12)	.19 (.12)	.21 (.13)	.26 (.15)	.28 (.11)	.55 (.13)
		2.0	.09 (.06)	.12 (.08)	.17 (.12)	.19 (.07)	.48 (.16)	.18 (.14)	.23 (.18)	.28 (.22)	.24 (.07)	.57 (.19)
4	.50	0.4	.12 (.06)	.22 (.10)	.37 (.19)	.55 (.12)	.72 (.07)	.27 (.15)	.37 (.21)	.49 (.28)	.65 (.14)	.79 (.04)
		1.2	.16 (.10)	.28 (.15)	.39 (.22)	.53 (.11)	.75 (.10)	.29 (.18)	.36 (.22)	.50 (.30)	.60 (.13)	.82 (.08)
		2.0	.22 (.14)	.31 (.19)	.44 (.27)	.48 (.14)	.76 (.13)	.31 (.22)	.40 (.27)	.52 (.38)	.54 (.12)	.82 (.15)
8	.20	0.4	.05 (.03)	.10 (.04)	.16 (.06)	.29 (.09)	.44 (.08)	.07 (.03)	.12 (.04)	.17 (.06)	.30 (.08)	.42 (.06)
		1.2	.05 (.03)	.11 (.05)	.16 (.07)	.29 (.10)	.48 (.10)	.08 (.03)	.13 (.05)	.18 (.07)	.29 (.09)	.47 (.09)
		2.0	.05 (.03)	.11 (.05)	.17 (.08)	.26 (.08)	.50 (.11)	.08 (.04)	.12 (.06)	.19 (.09)	.26 (.07)	.50 (.11)
8	.50	0.4	.07 (.03)	.21 (.07)	.36 (.13)	.59 (.11)	.75 (.07)	.11 (.04)	.24 (.08)	.37 (.13)	.61 (.09)	.74 (.04)
		1.2	.10 (.05)	.22 (.09)	.39 (.16)	.57 (.10)	.77 (.07)	.13 (.05)	.25 (.09)	.40 (.18)	.59 (.10)	.77 (.06)
		2.0	.12 (.06)	.24 (.09)	.40 (.17)	.56 (.11)	.79 (.08)	.15 (.07)	.27 (.11)	.43 (.19)	.56 (.09)	.80 (.08)

Note: The first number in each cell is the sample mean of $e^*(K)$; the second number (in parentheses) is its standard deviation.

posed approximation increases as the firm increases in average level of service consumption (as measured by α) and/or size (as measured by n). Thus, although the proposed approximation outperforms the direct and step methods in virtually all the cases examined, it is most effective for large firms with high service consumption and row-sum homogeneity, even when relatively large parameter estimation errors are allowed.

Overall, the data suggest that for many real-world firms, the proposed approximation could be useful by providing more accurate marginal service cost data than are currently available with either the direct or step allocation methods.

SUMMARY

This paper has presented a new method for approximating reciprocal service costs. It was shown analytically that under certain conditions, the method will provide approximations that converge to these reciprocal costs. A numerical procedure was used to compare the accuracy of the approximation with the corresponding accuracy of direct and step allocations, and it was found that the proposed method was more accurate for a wide range of service-related parameter values. Thus, for many firms, use of this approximation will permit more accurate marginal cost assessments and perhaps result in improved service-related operating decisions.

APPENDIX A

The purpose of this appendix is to demonstrate the validity of the error function in (3). In the proof, use is made of an $n \times 1$ vector of ones (a unit vector), denoted $s=[1]_{n\times 1}$, that allows r to be written as $r=As$.

Lemma 1: For $n \times 1$ vector y: $Hy=y+AHy$

Proof:
$$\begin{aligned} Hy &= Hy-AHy+AHy \\ &= (I-A)Hy+AHy \\ &= y+AHy && \textit{since } H=(I-A)^{-1} \end{aligned}$$

Lemma 2: $HA=AH$

Proof: The proof uses the fact that for any nonnegative matrix A whose columns sum to less than one, $H=(I+A+A^2+A^3+\ldots)$ (see Chiang, [1974], p. 128). This condition is satisfied in a reciprocal cost setting if every service department provides some service to at least one production department. Using this result, the proof is:

$$\begin{aligned} HA &= (I+A+A^2+\ldots)A \\ &= A(I+A+A^2+\ldots) \\ &= AH \end{aligned}$$

Proof of error function:

$$\begin{aligned} x &= Hb \\ &= H(\beta s+\Delta b) \\ &= H[(\lambda-\lambda\alpha)s+\Delta b] && \text{since } \lambda=\beta/(1-\alpha)\rightarrow\beta=\lambda-\lambda\alpha \\ &= H(\lambda\cdot s)+H(\Delta b-\lambda\alpha\cdot s) \\ &= [\lambda\cdot s+AH(\lambda\cdot s)]+H(\Delta b-\lambda\alpha\cdot s) && \text{using } \textit{Lemma 1} \text{ for } y=\lambda\cdot s \\ &= \lambda\cdot s+\lambda\cdot HAs+H(\Delta b-\lambda\alpha\cdot s) && \text{since } HA=AH \text{ from } \textit{Lemma 2} \\ &= \lambda\cdot s+H(\lambda\cdot r)+H(\Delta b-\lambda\alpha\cdot s) && \text{since } r=As \\ &= \lambda\cdot s+H(\lambda\cdot r+\Delta b-\lambda\alpha\cdot s) \\ &= \lambda\cdot s+H(\Delta b+\lambda\cdot\Delta r) && \text{since } \Delta r=r-\alpha\cdot s \qquad \text{(A1)} \end{aligned}$$

Now the error function can be written:

$$
\begin{aligned}
e^{\hat{x}}=x-\hat{x}&=[\lambda\bullet s+H(\Delta b+\lambda\bullet\Delta r)]-(b+\lambda\bullet r)\\
&=\lambda\bullet s+H(\Delta b+\lambda\bullet\Delta r)-(\beta\bullet s+\Delta b)-\lambda\bullet(\alpha\bullet s+\Delta r)\\
&=\lambda\bullet s+H(\Delta b+\lambda\bullet\Delta r)-(\Delta b+\lambda\bullet\Delta r)-(\beta+\lambda\alpha)\bullet s\\
&=(H-I)\Delta b+\lambda\bullet(H-I)\Delta r \qquad \text{since } \lambda=\beta+\lambda\alpha
\end{aligned}
$$

Appendix B

The reformulation in (4) follows directly from (2):

$$
\begin{aligned}
\hat{x}_i&=b_i+\lambda r_i\\
&=(\beta+\Delta b_i)+\lambda(\alpha+\Delta r_i)\\
&=(\beta+\lambda\alpha)+(\Delta b_i+\lambda\Delta r_i)\\
&=\lambda+(\Delta b_i+\lambda\Delta r_i) \qquad \text{since } \lambda=\beta+\lambda\alpha
\end{aligned}
$$

Appendix C

The purpose of this appendix is to derive the relationships shown in (5a) and (5b). The derivation of (5a) involves writing the vector relationship (A1) in Appendix A for each i:

$$x_i=\bar{x}+\Delta x_i=\lambda+\sum_j h_{ij}(\Delta b_j+\lambda\Delta r_j) \tag{C1}$$

Summing over i:

$$n\bar{x}=n\lambda+\sum_i\sum_j h_{ij}(\Delta b_j+\lambda\Delta r_j) \qquad \text{since } \sum_i\Delta x_i=0$$

and dividing by n:

$$\bar{x}=\lambda+(1/n)\sum_i m_i \qquad \text{where } m_i=\sum_j h_{ij}(\Delta b_j+\lambda\Delta r_j)$$

To derive the relationship in (5b), Δx_i is solved for in (C1) after substituting for m_i:

$$
\begin{aligned}
\Delta x_i&=(\lambda-\bar{x})+m_i\\
&=m_i-(1/n)\sum_i m_i
\end{aligned}
$$

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An Empirical Examination of the Potential Measurement Error in Current Cost Data

Keith A. Shriver

ABSTRACT: The Financial Accounting Standards Board (FASB) is soliciting empirical evidence on the accuracy of price indexes for estimating the current cost of machinery and equipment in compliance with Statement #33. Recent studies indicated that measurement errors in current cost data appear to dominate the potential information content of the Statement #33 disclosures. This study investigates the sign, magnitude, and sources of the potential measurement error in the estimates of current cost generated by alternative levels of specificity of the Producer Price Indexes (PPI). The research method consists of statistical analyses to examine the distributional properties of the PPI estimates compared to the criterion variable of the actual current order price of the assets. The results indicate that, in general, the measurement error tends to be an overstatement of new current cost. The major sources of measurement error appear to be product mix errors, pricing errors, and inadequate adjustments for quality change. Product mix errors seem to be the dominant factor for Electrical and Miscellaneous Equipment, pricing errors for General Purpose Equipment, and inadequate quality change adjustments for Machine Tools and Special Industry Equipment.

THE Financial Accounting Standards Board [FASB 1981, 1983b] is soliciting empirical evidence on the accuracy of price indexes for estimating the supplemental current cost data for machinery and equipment required to be disclosed by Statement of Financial Accounting Standards No. 33 (Statement #33) [FASB, 1979]. According to Arthur Young [1980, 1981] and Perry and Searfoss [1983], over 90 percent of the preparers of current cost data use indexation to estimate the current cost of machinery and equipment. Furthermore, over 90 percent of the indexes used are derived from external sources. The most

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prevalent and comprehensive externally-generated price indexes for machinery and equipment are the Producer Price Indexes [BLS, 1982]. According to Skousen and Albrecht [1984], the Producer Price Indexes (PPI) are the most frequently used measurement techniques for machinery and equipment and, therefore, the accuracy of those estimators was the focal point of this study.[1]

The remainder of this paper is organized as follows. The first section presents the research issues of the study; the second section discusses the sources of potential measurement error in the PPI; the third section describes the research method; the fourth section discusses the results; and the fifth section presents the summary and conclusions. The limitations and suggestions for future research are discussed in the last section.

RESEARCH ISSUES

Beaver and Landsman [1983] concluded that measurement errors in current cost data appear to dominate the potential information content of Statement #33.[2] Since the PPI are the most frequently used measurement techniques for estimating the current cost of machinery and equipment, the purpose of this study was to investigate the potential measurement error in current cost data generated by alternative levels of the PPI for various types of assets of different ages.[3]

Alternative Levels of Specificity of the PPI

Some auditors [e.g., Coopers & Lybrand, 1980] are concerned that a general PPI may not generate accurate estimates for individual assets. In contrast, Tritschler [1969], Sunder and Waymire [1983, 1984], and Casler and Hall [1985] concluded (in the absence of actual price data) that marginal gains in *ex ante* accuracy at the firm level decline sharply as the specificity of price indexes is increased. Also, Sunder [1978] analytically demonstrated that the bias of current cost estimates with respect to a specific firm does not necessarily decrease with an increase in either the number or the fineness of price indexes used. Finally, Shriver [1986] (using actual price data) concluded that the *ex post* accuracy of the current cost estimates for homogeneous groups of assets is significantly affected by the level of PPI specificity, and that the most specific indexes are not always the best estimators for those assets. Since Statement #33 allows complete flexibility with respect to the choice of index specificity, the sign, magnitude, and sources of potential measurement error in four alternative levels of the PPI were examined in this study.

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[1] Various terms pertaining to the measurement and estimation of current cost data are used in this study. These terms are defined as follows:

a. "Current Cost"—the current cost of acquiring the same service potential (indicated by operating costs and physical output capacity) as embodied by the asset owned.
b. "Measurement Attribute"—the financial representation of a trait or aspect of an object being measured (historical cost, current cost, etc.).
c. "Measurement Technique"—the manner of estimating the designated measurement attribute (current order prices, price indexes, etc.).

[2] The term "measurement error" may conjure up visions of a deviation from a "true" amount. However, ultimate truth is a metaphysical concept outside the purview of accounting. For the purposes of this study, measurement error is construed to be the deviation of an estimate (PPI) from a designated environmental criterion (current order price) and the dispersion of various estimates of the criterion. Furthermore, this study is not dependent upon the illusive concept of one "true income." In fact, a true income amount may not exist [Beaver and Demski, 1979; Gonedes and Dopuch, 1974, 1979].

[3] This study is limited to the estimation of the *new* current cost of assets. Beaver and Landsman [1983] advocate the utilization of indexes based upon used asset prices to reduce the measurement errors in estimating *used* current cost and current cost depreciation. However, used asset indexes may be available for only a limited number of assets such as automobiles and other vehicles [FASB, 1983b].

Types of Assets

The sign, magnitude, and sources of potential measurement error in the PPI estimates of current cost may differ among types of assets. This possibility was investigated by examining the entire field of industrial machinery and equipment.

Ages of Assets

Shriver [1986] concluded that the PPI generally are more accurate for recent acquisitions than for older acquisitions. This study investigates whether the sign, magnitude, and sources of potential measurement error are consistent over two ages of assets. The Bureau of Economic Analysis and the Bureau of Industrial Economics (Department of Commerce) both calculate the average age of industrial machinery and equipment currently held by business enterprises in the United States to be seven years.[4] Age groups of seven and four years were selected in order to compare the "average" age of seven years with a more recent vintage.

SOURCES OF POTENTIAL MEASUREMENT ERROR IN THE PPI

For many years, economists have been concerned with the validity and accuracy of the price measures used in various economic analyses that ultimately affect national economic policy. The PPI constitute an important source for such price measures. For instance, the PPI are used in the public sector to measure the change in purchasing power of the dollar in primary markets, to analyze government policies directed at specific industries, and to calculate various components of the gross national product deflators. In addition, the PPI are used in the private sector to assist in forecasting, marketing analysis, escalating purchase contracts, and estimating current cost data for machinery and equipment in compliance with Statement #33. The major sources of potential measurement error in the PPI estimates of current cost data appear to be (1) product mix errors and aggregation effects, (2) price data errors, and (3) substitution bias and inadequate adjustments for quality change.

Product Mix Errors and Aggregation Effects

Product mix errors occur when the relative weights of commodities used in the construction of the PPI differ from the relative weights of commodities held by the firm. In other words, the product mix or portfolio of machinery and equipment owned by the firm is not identical to the sample of machinery and equipment contained in the PPI. Furthermore, commodity prices change in varying patterns. Thus, the product mix errors include any differences between the weights and price changes of the commodities contained in the PPI and the weights and price changes of the commodities owned by the firm.

In addition, Statement #33 allows firms to choose the level of aggregation of asset groups to be reported. This choice may induce an aggregation effect that may not be consistent over time within a firm or comparable across firms. For example, one firm may aggregate all of its machinery and equipment into one group and then apply a general machinery and equipment index for reporting purposes. In contrast, a second firm may report separate subgroups of types of machinery and equipment and then apply a specific index for each reported subgroup. Finally, a third firm may maintain separate subgroup internal records and apply a specific index to each subgroup but then aggregate the specific results into one general amount for reporting purposes. Even though the three firms may possess identical product mixes, the measurement error could differ across the firms. Furthermore, the above scenario might pertain to *one* firm over a three-year period. Thus, the choice of level of asset aggregation for reporting purposes may induce an aggregation effect which is not consistent over time within a firm or comparable across firms.

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[4] This information was received via a letter from the U.S. Department of Commerce, Bureau of Industrial Economics.

Since each firm may adopt a different policy on the level of asset aggregation to be reported, and this policy may vary from year to year, general empirical results on the properties of product mix error should be free from these effects of managerial choice of asset aggregation. Therefore, this study focuses on the individual assets that comprise the industrial machinery and equipment field. Thus, the choice of the level of asset aggregation was "held constant."

Previous accounting research on the accuracy of the PPI concentrated on product mix errors and aggregation effects and "assumed away" potential errors in the raw price data and in the adjustments for quality change [Sunder, 1978; Sunder and Waymire, 1983, 1984; Casler and Hall, 1985].[5] Those prior studies did not use actual price data as a criterion for current cost, and thus were able to assess only the *relative* efficiency of various PPI as compared to each other.[6] Hence, they could only conjecture about the *absolute* magnitude of the mean square error of aggregation that accompanies valuation rules at a given level of aggregation.

Shriver [1986] used actual price data and extended the previous research. He examined the absolute magnitude of the accuracy of alternative PPI at different levels of asset aggregation for homogeneous groups of assets. However, he did not investigate the sign or major sources of the absolute errors of valuation. If the sign and sources of measurement error could be determined, improvements in future valuation accuracy might be attained. Therefore, one purpose of this study was to extend Shriver [1986] and to examine the sign and three potential sources of measurement error in PPI estimates of current cost data: product mix errors, price data errors, and inadequate adjustments for quality change.

Price Data Errors

The Bureau of Labor Statistics (BLS) obtains price quotations for index construction from trade publications or manufacturers on a voluntary and confidential basis. The nominal price quotations submitted to the BLS may not represent the current order cost of the assets due to reliance on antiquated price lists in some circumstances or lack of conscientious compliance in other situations. McAllister [1961], Flueck [1961], Dean and DePodwin [1961], Stigler and Kindahl [1970], Hay [1972], and Fethke and Belmont [1973] concluded that the traditional sellers' realization prices used in the PPI are not as accurate as buyers' prices. Therefore, in this study the current order price (buyers' price) was used as the criterion for the current cost of the asset.

Substitution Bias and Inadequate Adjustments for Quality Change

The PPI are based on a Laspeyres

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[5] Subsequent to the conduct of this study, Lim and Sunder [1986] extended the prior analytical research [Sunder, 1978] by dropping the assumption of zero pricing data errors. However, the Lim and Sunder [1986] analytical formulations apparently do not incorporate a variable for quality change errors.

[6] See Dopuch [1982] for a discussion of the importance of a "criterion variable" in empirical research.

Index construction (fixed-weight formula) and a potential upward bias of estimation may exist when the substitution of cheaper goods with the same quality is not reflected in the PPI. According to Triplett [1975], the substitution bias generally is not a significant source of measurement error.

In contrast, the task of devising adequate quality change adjustment techniques for the PPI has been very difficult for the BLS since complex machinery and equipment frequently incorporate a new generation of technological advances without corresponding increases in cost. Gordon [1974] argues that the BLS must rely on private communications with manufacturers for estimates of quality change and that in many instances quality change (change in the characteristics of products) is not separated from pure price change. Any failure (whether through technical measurement difficulties or lack of effort) to ascertain the technological progress embodied in new assets imparts an upward bias to the PPI data [BLS, 1982].

Triplett [1975] reviewed the empirical work on quality change in the PPI and concluded that the sign and magnitude of the quality change problem for *transportation* equipment still has not been determined. However, other researchers [e.g., Gordon, 1974] assert that the conventional wisdom of an upward bias in the PPI for small items of *machinery* and *equipment* is unassailable. In summary, it is generally believed that technological and quality change "imparts more error into price (index) measurement than does any other single source" [Triplett, 1975, p. 30; Revsine, 1979].

The prior accounting research did not address the issue of inadequate adjustments for quality change. Also, the prior economic studies that did address the problem of inadequate adjustments for quality change in the PPI were limited primarily to transportation equipment (automobiles) and small items of capital equipment contained in Sears and Roebuck catalogues. In contrast, this study extends the prior accounting and economic research by examining the quality change problem for the entire range of industrial machinery and equipment, including most standard specifications of assets used by business firms in diverse industries.

Summary

The PPI are based on nonstatistical judgment samples of commodities, of reporters of price data, and of technological specifications [BLS, 1982]. As a result, the overall problem of index accuracy includes product mix errors, pricing errors, and inadequate adjustments for quality change.

The BLS recently proposed the first comprehensive revision of the PPI since their inception in 1902 to reduce pricing errors and to improve the adjustments for quality change [Early, 1978, 1979]. However, recent cutbacks in Federal Statistical Programs have curtailed the proposed revisions and the designated problems in the PPI remain [Popkin, 1983].

RESEARCH METHOD

In essence, the research method consisted of two major stages:

1. field studies (a) to obtain the current order price of new industrial machinery and equipment for three years, with each year exhibiting an alternative degree of demand for machinery and equipment, and (b) to match the assets over the time series according to standard engineering specifications;
2. statistical analyses to examine the distributional properties of the esti-

mates of new current cost generated by various levels of the PPI as compared to the current order price obtained in (1) above.

Thus, the current order price of new machinery and equipment was used as the criterion for current cost and the PPI estimates were construed to be estimates of the criterion.

The aforementioned surveys of preparers of current cost data [Arthur Young, 1980, 1981; Perry and Searfoss, 1983; Skousen and Albrecht, 1984] did not disclose the specificity of PPI used for each asset group by each firm. Since Statement #33 allows firms to choose the specificity of the index used and the level of aggregation of asset groups to be reported, a consistent pattern probably does not exist. Therefore, one research approach would entail the use of several case studies of sample *firms*. However, that approach was not chosen since the results about product mix errors would be very firm-specific and probably not generalizable across firms. In contrast, this study focused on the individual *assets* that comprise the entire field of industrial machinery and equipment. Therefore, the results may be applied to any firm-specific product mix by sampling from the individual asset error metrics in the designated firm-specific proportions for each asset group.

Internal Validity

The repeated measures research design incorporated several features to control the following four threats to the internal validity of the study: instrument error, measurer error, reactive or obtrusive error, and environmental error [Mock, 1976].

Instrument error refers to the bias, inaccuracy, insensitivity, and inconsistency inherent in the measurement techniques. This type of error was the focus of this study, and therefore was allowed to vary.

Measurer error includes those properties of the measurer that can influence the measurement process. Copeland, Taylor, and Brown [1981] recommended that the person who plans the study should not be the person who observes the raw data. Therefore, in this study the raw price data were obtained from experts operating in the industrial machinery and equipment field. As a result, any unconscious bias or incompetence inherent in the researcher was eliminated from the research findings.

Reactive or obtrusive error occurs when the measurement process affects, disturbs, or biases relations among the objects being measured. Such errors were controlled by using price data and indexes that were not created especially for this research study. The price data and indexes were a "matter of record" and were not affected by the conduct of this study.

Environmental error refers to variations in the environment that affect the behavior of the observer, the techniques, and the objects being measured. This type of error was controlled by using the realism of actual markets. In addition, the estimates and the criterion data were compared at the same point in time. Thus, variations in the environment (price levels, interest rates, level of business activity, etc.) that affect prices were held constant.

External Validity

External validity describes the extent to which the results of any one study are generalizable to other samples, time periods, events, and settings. To increase the generalizability of the results, several factors were incorporated into the research design:

1. The data base used in this study was intended to be comprehensive and purported to include most of the standard specifications of industrial machinery and equipment used by business enterprises in diverse industries [Land, 1974, 1977, 1981].
2. The data were obtained from three contrasting years (1973, 1976, and 1980) to reflect time periods exhibiting alternative degrees of demand (high, low, moderate) for industrial machinery and equipment [Land, 1974, 1977, 1981].
3. Two age groups of assets (four and seven years) were employed to reflect the impact of vintage on the estimates of current cost [Shriver, 1986].

Current Order Prices of New Industrial Machinery and Equipment

The price data were obtained from pricing guides compiled by experts in the industrial machinery and equipment field for the benefit of purchasing agents of business enterprises. The experts acquired the current order cost (buyers' price) of the assets directly from the manufacturer, and the prices were considered to be applicable on a national basis [Land, 1974, 1977, 1981]. Furthermore, the experts have bought, sold, or appraised for many years most of the items included in the data base. Since prior economic studies concluded that the traditional sellers' realization prices used in the PPI are not as accurate as buyers' prices (see previous section on price data errors), the current order price data (buyers' prices) were *assumed* to be more accurate and more reliable than the raw price data used in the PPI.

The experts classified the assets into the 11 standard categories of industrial machinery and equipment used by dealers in the field:

1. Motors, starters, and drives.
2. Electrical generating and transmission equipment (transformers, generators, generating sets, turbo generators, etc.).
3. Machine tools (lathes, presses, milling machines, shears, etc.).
4. Material handling equipment (tanks, scales, compressors, pumps, cranes, etc.).
5. Process equipment (screens, crushers, grinders, pulverizers, and other equipment which changes or conditions a wide range of products).
6. Foundry and heat treating equipment (furnaces, forges, melters, ovens, etc.).
7. Heating, air conditioning, and refrigeration equipment.
8. Medical and laboratory equipment (microscopes, incubators, spectral analyzers and other testing equipment).
9. Food service equipment (restaurant ovens, refrigerators, griddles, broilers, etc.).
10. Printing equipment (phototypesetters, print processors, etchers, printing presses, etc.).
11. Miscellaneous equipment (dry cleaning, gas station, car wash, amusement park, etc.).

By definition, the data base did not include ordnance items, office equipment, EDP equipment, vehicles, and non-automatic hand tools.

The data base contained current order prices of approximately 5,000 assets for each of three years (1973, 1976, 1980). Prior to using the price data for statistical analysis, I matched the current order prices of the equivalent assets over the time series encompassing 1973, 1976, and 1980. The matching of those assets, according to standard engineering specifications, was necessary to focus on the price changes, separate and distinct from quality change.

The vast majority of the assets were directly matched with identical assets over the years. Those assets in the classifications most susceptible to technological change (machine tools, medical and laboratory equipment, and printing equipment) were matched to equivalent assets based upon either size specifications or output specifications, whichever was most appropriate for the designated asset. The matching was reviewed by industrial engineers and appraisers, and the state of technology was held constant over the statistical analyses. As a result of the matching process, the quality (technological) change problem apparent in the PPI and in previous research was controlled in this study.[7]

Producer Price Indexes

Four consecutive levels of increasing specificity of the PPI were examined in this study:

1. all business commodities index (PPI_1);
2. industrial commodities index (PPI_2);
3. machinery and equipment index (PPI_3); and
4. the five individual subgroup indexes for categories of machinery and equipment pertinent to this data base (PPI_4):
   Metalworking Machinery and Equipment,
   General Purpose Machinery and Equipment,
   Special Industry Machinery and Equipment,
   Electrical Machinery and Equipment,
   Miscellaneous Machinery and Equipment.

These levels represent the range from the most general to the most specific indexes used in most economic and accounting analyses. The remaining product classes, subproduct classes, and individual items' indexes may change composition frequently, may lack historical continuity, and may not be consistent in the level of specificity presented across assets over the years. Therefore, those indexes were not considered to be appropriate for this large-scale study of the assets which comprise the industrial machinery and equipment field.

Error Metric

Previous researchers [e.g., Sunder and Waymire, 1983; Casler and Hall, 1985] used the mean squared error as their relative measure of *ex ante* accuracy. In contrast, an *ex post* measure of valuation accuracy was deemed to be more appropriate for this study. Thus, the following standard forecasting error metric was adopted:

$$E=\frac{(\text{estimated}-\text{actual})}{\text{actual}}$$

$$E=\frac{COP_1\cdot\dfrac{PPI_2}{PPI_1}-COP_2}{COP_2}\times 100$$

where

PPI_2 = Producer Price Index at the end of the period,
PPI_1 = Producer Price Index at the beginning of the period,
COP_2 = Current order price at the end of the period, and
COP_1 = Current order price at the beginning of the period.

The error metric was calculated for each matched individual asset as follows:

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[7] The loss of observations during the matching process was minimal as only 15 items were discarded due to lack of information for all three years.

1. The 1973 current order price was used as an original purchase price and the PPI ratio from 1973–1980 was applied to this original purchase price to generate an estimate of the new current cost of a seven-year-old asset as of 1980. This estimate then was compared with the actual 1980 current order price to assess the accuracy of the PPI estimate.
2. Similarly, the 1976 current order price was used as an original purchase price and the PPI ratio from 1976 to 1980 was applied to the 1976 original price to generate an estimate of the new current cost of a four-year-old asset as of 1980. Again, this estimate then was compared with the actual 1980 current order price to assess the accuracy of the PPI estimate.
3. The columns labeled PPI_1 in Tables 1–5 (to follow) present the error metrics calculated from the above steps using the All Business Commodities index.
4. To prepare the PPI_2 columns of the tables, the All Industrial Commodities index was used.
5. The Machinery and Equipment index was used to prepare the PPI_3 columns of the tables.
6. Finally, the five subgroups indexes of Machinery and Equipment (Metalworking, General Purpose, Special Industry, Electrical and Miscellaneous) were used to prepare the PPI_4 columns. Specifically, the subgroup index most relevant to the individual asset (based upon the PPI classification system) was used to calculate the error metric.

In summary, the error metric (*E*) represents the percentage deviation of the PPI estimate from the current order price of the asset at the date of the measurement. It reveals the percentage understatement (−) or overstatement (+) attributable to the PPI estimate of current cost at the measurement date. Therefore, the error metrics, expressed as percentage deviations, allowed comparisons of the research results among:

1. different levels of specificity of the PPI,
2. different assets of unequal costs, and
3. different ages of assets.

In addition, the results may be applied to any firm-specific asset mix or net price differentials created by firm-specific phenomena (discounts, rebates, geographical proximity, and other "arrangements" with suppliers [Stigler, 1961]) by sampling from the individual-asset error metrics in the designated firm-specific proportions for each asset group.

RESULTS

The discussion of the results of this study is separated into two sections. First, the sign and magnitude of the total potential error in the estimates for each of the four levels of the PPI are presented for two ages of assets. Second, the sources of the total potential error are examined.

Total Error

As discussed previously, the total potential error in PPI estimates of machinery and equipment may consist of product mix errors and aggregation effects, pricing errors, and quality change errors. The sign and magnitude of the total potential errors for each of the four PPI are presented as confidence intervals in Table 1. These confidence intervals were constructed from the individual asset error metrics aggregated into homogeneous asset groups, based on the

TABLE 1

PERCENTAGE DEVIATIONS OF THE PPI ESTIMATES FROM THE CURRENT ORDER PRICE OF THE ASSETS
OVERSTATEMENTS AND [UNDERSTATEMENTS]
95 PERCENT CONFIDENCE INTERVALS

		Seven-Year-Old Assets as of 1980 (1973–1980)				*Four-Year-Old Assets as of 1980 (1976–1980)*			
Classification	*N*	PPI_1	PPI_2	PPI_3	PPI_4	PPI_1	PPI_2	PPI_3	PPI_4
Motors, Starters and Drives	469	27–34% (2)	41–47% (4)	30–38% (3)	20–26% (1)	10–14% (3)	13–18% (4)	5–9% (2)	3–7% (1)
Electrical Generating and Transmission	525	5–9% (2)	17–22% (4)	8–12% (3)	[1]–3% (1)	7–9% (3)	11–12% (4)	3–5% (2)	1–2% (1)
Miscellaneous	433	4–7% (2)	16–19% (4)	7–10% (3)	1–4% (1)	8–10% (3)	11–13% (4)	4–5% (2)	[1]–0% (1)
Machine Tools	588	12–14% (1)	24–27% (3)	15–17% (2)	26–29% (4)	6–8% (2)	9–11% (4)	2–3% (1)	8–10% (3)
Medical and Laboratory	419	17–21% (1)	31–34% (4)	21–24% (2)	29–32% (3)	11–12% (2)	14–15% (4)	6–7% (1)	11–12% (3)
Printing	147	10–14% (1)	23–27% (4)	13–17% (2)	21–25% (3)	10–11% (2)	13–15% (4)	5–7% (1)	10–11% (3)
Material Handling	999	[1]–1% (1)	10–12% (4)	2–3% (2)	8–9% (3)	[1]–[1]% (1)	1–2% (2)	[5]–[5]% (3)	[7]–[6]% (4)
Process	542	[14]–[12]% (4)	[5]–[2]% (1)	[12]–[10]% (3)	[7]–[5]% (2)	[1]–0% (1)	2–3% (2)	[5]–[4]% (3)	[7]–[5]% (4)
Food Service	266	13–17% (1)	26–30% (4)	16–20% (2)	24–28% (3)	8–9% (3)	11–12% (4)	4–5% (1)	8–9% (2)
Heating, Air Conditioning and Refrigeration	310	3–7% (1)	15–19% (4)	6–10% (2)	12–16% (3)	6–6% (3)	9–9% (4)	1–2% (2)	0–0% (1)
Foundry and Heat Treating	177	[21]–[17]% (4)	[12]–[8]% (2)	[18]–[15]% (3)	[10]–[6]% (1)	4–6% (2)	7–9% (4)	1–1% (1)	7–8% (3)
	4875								

Note: The rankings in parentheses were determined by the medians and the means of the classifications. The rankings were consistent over either measure of central tendency.

11 standard classifications of industrial machinery and equipment used by many experts in the field. The classifications are a "matter of record" [Land, 1981], and thus, the choice of level of asset aggregation and the aggregation effect were "held constant" over the various PPI and over the two ages of assets.

The most specific level of the PPI did not always generate the smallest total error for all classifications of industrial machinery and equipment.[8] Based upon the Friedman nonparametric rank order tests of medians and of means, PPI_1 was the best overall estimator for seven-year-old assets (both tests consistent and significant at .025), while PPI_3 was the most accurate estimator on an overall basis for four-year-old assets (both tests consistent and significant at .005).

In addition, each alternative level of the PPI was more accurate for the estimation of four-year-old assets than for seven-year-old assets,[9] based upon the Wilcoxon nonparametric one-tailed matched pair tests of medians and of means (both tests consistent and significant for every level at .005). The "best" confidence interval among alternative PPI for each classification of four-year-old assets tended to range from a 0-0 percent to 6-7 percent. In contrast, the "best" confidence interval among alternative PPI for each classification of seven-year-old assets tended to range from a [1]-1 percent to 20-26 percent (see Table 1).

Sources of the Error

In addition to the confidence intervals presented in Table 1, Tables 2-5 present frequency distributions of the error metrics for each individual asset. Thus, the frequency distributions "hold constant" the choice of level of asset aggregation by focusing on the individual asset. Accordingly, the frequency distributions may provide additional insights as to the dominant source of measurement error for the individual assets within each standard classification of industrial machinery and equipment.

Product Mix Errors

For example, total error for an individual asset should diminish as the PPI becomes more specific if the dominant source of error is the product mix problem. Thus, PPI_4 should be the best estimator for both ages of assets in this scenario. The rank orders for Motors, Starters, and Drives, Electrical Generating and Transmission Equipment, and Miscellaneous Equipment generally are consistent with this pattern[10] (see Table 1).

According to the frequency distributions (see Table 2), the pattern appears to be more evident for four-year-old assets than for seven-year-old assets, and more apparent for Miscellaneous Equipment than for Electrical Equipment or Motors, Starters, and Drives. For example, 98 percent of the PPI_4 individual asset error metrics for four-year-old Miscellaneous Equipment are concentrated between -15 and 15 as compared to 84 percent within this range for the seven-year-old equipment. Also, 89 percent of the PPI_4 metrics for four-year-old Electrical Generating and Transmission Equipment are included between -15 and 15, while only 38 percent are within this range for seven-year-old equipment. Finally, 53 percent of the PPI_4 error metrics for four-year-old Motors, Starters, and Drives are located within -15

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[8] This empirical result is consistent with Shriver [1986] and the Lim and Sunder [1986] analytical Theorem 7.

[9] This empirical result is consistent with Shriver [1986].

[10] This empirical result is consistent with the Lim and Sunder [1986] analytical Theorem 6 in which the pricing errors are small relative to the product mix errors.

TABLE 2

PERCENTAGE DEVIATIONS OF PPI ESTIMATES FROM THE CURRENT ORDER PRICE OF THE ASSET
POSSIBLE DOMINANCE OF PRODUCT MIX ERRORS

	Seven-Year-Old Assets (1973–1980)								*Four-Year-Old Assets (1976–1980)*							
	PPI_1		PPI_2		PPI_3		PPI_4		PPI_1		PPI_2		PPI_3		PPI_4	
Frequency Distribution of Percentage Deviations	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %.*
MOTORS, STARTERS, AND DRIVES																
−26 or less	14	3	7	1	11	2	23	5	59	13	59	13	62	13	63	13
−25 to −21	9	2	4	1	7	2	17	4	3	0	3	0	3	1	3	1
−20 to −16	17	4	6	1	11	2	25	5	4	1	1	0	4	1	3	1
−15 to −11	20	4	8	2	17	4	39	8	3	0	6	1	4	1	8	2
−10 to − 6	40	8	16	3	26	5	14	3	4	1	2	0	10	2	20	4
− 5 to 0	18	4	26	6	38	8	31	7	19	4	8	2	90	19	134	29
1 to 5	28	6	35	7	22	5	23	5	100	21	54	11	102	22	60	13
6 to 10	17	4	13	3	20	4	38	8	89	20	99	21	32	7	23	5
11 to 15	37	8	23	5	27	6	40	8	27	6	59	13	8	2	2	0
16 to 20	40	8	16	3	31	7	22	5	7	1	22	5	1	0	1	0
21 to 25	24	5	26	6	39	8	9	2	1	0	3	1	1	0	1	0
26 or more	205	44	289	62	220	47	188	40	153	33	153	33	152	32	151	32
	469	100	469	100	469	100	469	100	469	100	469	100	469	100	469	100
ELECTRICAL GENERATING AND TRANSMISSION EQUIPMENT																
−26 or less	24	5	17	3	20	4	71	14	0	0	0	0	0	0	0	0
−25 to −21	49	9	1	0	36	7	45	9	0	0	0	0	1	0	2	0
−20 to −16	43	8	18	3	57	11	41	8	2	0	0	0	3	1	3	1
−15 to −11	34	6	48	9	22	4	36	7	2	0	2	0	5	1	8	1
−10 to − 6	42	8	33	6	39	7	49	9	6	1	5	1	13	2	46	9
− 5 to 0	51	10	43	8	39	7	28	5	36	7	12	2	208	40	289	55
1 to 5	20	4	32	6	38	7	22	4	260	50	135	26	151	29	47	9
6 to 10	26	5	40	8	28	6	36	7	76	15	196	38	35	7	32	6
11 to 15	22	4	25	5	22	4	32	6	36	7	42	8	38	7	49	9
16 to 20	31	6	25	5	27	5	23	4	36	7	32	6	33	6	19	4
21 to 25	34	7	19	4	29	6	27	5	32	6	38	7	22	4	16	3
26 or more	149	28	224	43	168	32	115	22	39	7	63	12	16	3	14	3
	525	100	525	100	525	100	525	100	525	100	525	100	525	100	525	100
MISCELLANEOUS EQUIPMENT																
−26 or less	3	0	2	0	3	1	2	1	0	0	0	0	0	0	0	0
−25 to −21	4	1	0	0	1	0	12	3	0	0	0	0	0	0	0	0
−20 to −16	13	4	1	0	12	3	8	2	0	0	0	0	1	0	2	0
−15 to −11	8	2	8	2	7	2	17	4	1	0	0	0	1	0	4	1
−10 to − 6	39	9	9	2	17	4	68	16	1	0	2	0	5	1	36	8
− 5 to 0	103	24	12	3	83	19	105	24	18	4	4	1	106	25	250	58
1 to 5	73	17	37	9	83	19	79	18	140	32	33	8	186	43	106	25
6 to 10	70	16	83	19	79	18	46	10	154	36	146	34	99	23	16	4
11 to 15	54	12	67	15	49	11	51	12	85	20	150	35	16	4	11	2
16 to 20	26	6	73	17	51	12	9	2	14	3	67	15	11	2	0	0
21 to 25	8	2	42	10	10	2	11	2	12	3	14	3	0	0	0	0
26 or more	32	7	99	23	38	9	25	6	8	2	17	4	8	2	8	2
	433	100	433	100	433	100	433	100	433	100	433	100	433	100	433	100

and 15 as contrasted with 39 percent for the seven-year-old assets (see Table 2).

In summary, product mix errors might be the dominant source of error for these three classifications since PPI$_4$ is statistically the best estimator for both ages of assets. In addition, this source appears to be more pronounced for four-year-old assets and for the classification of Miscellaneous Equipment.

Quality Change Errors

However, if PPI$_4$ is not the best estimator for a single asset of both ages, then inadequate adjustments for quality change or pricing errors may dominate.

For instance, if the estimators consistently generate an overstatement of new current cost, then the errors may be largely due to inadequate adjustments for quality change [BLS, 1982]. The classifications of Machine Tools, Medical and Laboratory Equipment, and Printing Equipment have been affected by technological change [Land, 1981] and fit the pattern of a consistent and significant overstatement of new current cost[11] (see Table 1).

According to the statistical analyses, PPI_4 is not the best estimator for either age of assets in these classifications (see Table 1). Furthermore, the frequency distributions indicate that PPI_4 overstated the new current cost of at least 96 percent of both the seven-year-old and four-year-old assets in all three classifications (see Table 3). Thus, inadequate adjustments for quality change appear to be the major source of error for Machine Tools, Medical and Laboratory Equipment, and Printing Equipment.

Pricing Errors

PPI_4 is not the best estimator for either age of Material Handling Equipment, Process Equipment, or Food Service Equipment (see Table 1). However, these classifications have not been subjected to significant quality change [Land, 1981], and therefore, inadequate adjustments for quality change may not be a viable candidate for the dominant source of error. In contrast, pricing errors appear to be a major source of error since these classifications exhibit both understatements and overstatements of new current cost.

For example, the frequency distributions for PPI_4 indicate that 24 percent of the seven-year-old Material Handling Equipment and 94 percent of the four-year-old equipment are *understated*. Also, 74 percent of the seven-year-old Process Equipment and 81 percent of the four-year-old equipment are *understated* by PPI_4. Conversely, 99 percent of both the seven-year-old and four-year-old Food Service Equipment are *overstated* by PPI_4 (see Table 4). In summary, these classifications (not affected by technological change) exhibit both understatements and overstatements of new current cost which may be due to a pricing error dominance since the most specific index is not the best estimator for either age of asset.[12]

No Apparent Consistent Dominance

The two classifications of Heating, Air Conditioning and Refrigeration Equipment, and Foundry and Heat Treating Equipment have not been affected by significant technological change [Land, 1981] and do not indicate a consistent dominant source of error. For instance, PPI_1 is the best estimator for seven-year-old Heating, Air Conditioning, and Refrigeration Equipment, while PPI_4 is the best estimator for the four-year-old equipment (see Table 1). Thus, pricing errors appear to dominate for seven-year-old assets but product mix errors seem to dominate for four-year-old assets.

Conversely, PPI_4 is the best estimator for seven-year-old Foundry and Heat Treating Equipment while PPI_3 is the best estimator for the four-year-old assets in that classification (see Table 1). Thus, product mix errors might be dominant for seven-year-old assets but pricing errors appear to be dominant for four-year-old assets. In any event, no apparent consistent source of error appears to

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[11] This empirical result is consistent with Gordon [1974].

[12] This empirical result is consistent with the Lim and Sunder [1986] analytical Theorem 5 in which the pricing errors are large compared to the product mix errors.

TABLE 3

PERCENTAGE DEVIATIONS OF PPI ESTIMATES FROM THE CURRENT ORDER PRICE OF THE ASSET POSSIBLE DOMINANCE OF QUALITY CHANGE ERRORS

	Seven-Year-Old Assets (1973–1980)								*Four-Year-Old Assets (1976–1980)*							
	PPI_1		PPI_2		PPI_3		PPI_4		PPI_1		PPI_2		PPI_3		PPI_4	
Frequency Distribution of Percentage Deviations	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %.*
MACHINE TOOLS																
−26 or less	5	1	4	1	5	1	3	1	0	0	0	0	0	0	0	0
−25 to −21	1	0	1	0	1	0	1	0	0	0	0	0	1	0	0	0
−20 to −16	2	0	0	0	1	0	1	0	2	0	1	0	3	0	1	0
−15 to −11	1	0	2	0	2	0	1	0	3	0	2	0	4	1	2	0
−10 to − 6	32	6	1	0	10	2	1	0	4	1	4	1	17	3	5	1
− 5 to 0	63	11	2	0	54	9	2	0	63	11	12	2	284	48	16	3
1 to 5	101	17	36	6	69	12	30	5	285	49	200	34	156	26	213	36
6 to 10	102	17	50	9	116	20	34	6	111	19	191	33	52	9	185	32
11 to 15	91	15	73	13	97	17	62	11	49	8	67	11	34	6	66	11
16 to 20	54	9	99	17	73	12	96	16	33	6	46	8	7	1	44	7
21 to 25	32	6	90	15	43	7	92	16	8	1	32	5	9	2	23	4
26 or more	104	18	230	39	117	20	265	45	30	5	33	6	21	4	33	6
	588	100	588	100	588	100	588	100	588	100	588	100	588	100	588	100
MEDICAL AND LABORATORY EQUIPMENT																
−26 or less	2	0	2	0	2	1	2	0	0	0	0	0	0	0	0	0
−25 to −21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
−20 to −16	2	0	0	0	2	1	0	0	0	0	0	0	0	0	0	0
−15 to −11	3	1	1	0	2	1	1	0	0	0	0	0	1	0	0	0
−10 to − 6	17	4	1	0	9	2	3	1	1	0	0	0	4	1	1	0
− 5 to 0	29	7	7	2	22	5	8	2	11	3	5	1	57	14	11	3
1 to 5	28	7	13	3	26	6	15	4	69	16	17	4	122	29	69	16
6 to 10	43	10	26	6	32	7	27	6	117	28	91	22	167	40	117	28
11 to 15	68	16	18	4	60	14	23	6	160	38	107	25	40	10	160	38
16 to 20	62	15	33	8	63	15	38	9	33	8	147	35	22	5	33	8
21 to 25	40	10	57	14	42	10	60	14	21	5	28	7	6	1	21	5
26 or more	125	30	261	63	159	38	242	58	7	2	24	6	0	0	7	2
	419	100	419	100	419	100	419	100	419	100	419	100	419	100	419	100
PRINTING EQUIPMENT																
−26 or less	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
−25 to −21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
−20 to −16	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
−15 to −11	1	0	0	0	1	0	0	0	1	0	1	1	0	0	1	0
−10 to − 6	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0
− 5 to 0	10	7	1	1	4	3	0	0	0	0	0	0	12	8	0	0
1 to 5	36	25	0	0	20	14	0	0	20	14	2	1	76	52	20	14
6 to 10	36	25	8	5	36	25	12	8	73	50	37	25	29	20	73	50
11 to 15	23	16	24	16	32	22	32	22	27	19	62	42	21	14	27	19
16 to 20	15	10	31	21	23	15	26	18	18	12	23	16	8	6	18	12
21 to 25	11	7	29	20	9	6	24	16	8	5	14	9	0	0	8	5
26 or more	15	10	54	37	22	15	52	35	0	0	8	6	0	0	0	0
	147	100	147	100	147	100	147	100	147	100	147	100	147	100	147	100

be dominant for these two classifications[13] (see Table 5).

SUMMARY AND CONCLUSIONS

The results of this study indicate that measurement error varies among the alternative levels of the PPI for different types and ages of assets. Thus, the accuracy of the current cost data may be affected by the choice of the level of PPI

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[13] This empirical result is consistent with the Lim and Sunder [1986] analytical Theorem 7 in which the most accurate valuation is obtained by using price indexes at some intermediate level of specificity, where the combination of product mix errors and pricing errors finds an appropriate balance.

TABLE 4

PERCENTAGE DEVIATIONS OF PPI ESTIMATES FROM THE CURRENT ORDER PRICE OF THE ASSET POSSIBLE DOMINANCE OF PRICING ERRORS

	Seven-Year-Old Assets (1973–1980)								*Four-Year-Old Assets (1976–1980)*							
	PPI_1		PPI_2		PPI_3		PPI_4		PPI_1		PPI_2		PPI_3		PPI_4	
Frequency Distribution of Percentage Deviations	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %.*
MATERIAL HANDLING EQUIPMENT																
−26 or less	30	3	21	2	27	3	26	3	3	0	3	0	4	0	7	1
−25 to −21	20	2	6	1	13	1	2	0	4	0	1	0	10	1	8	1
−20 to −16	36	4	11	1	22	2	13	1	8	1	9	1	19	2	38	4
−15 to −11	64	6	16	2	48	5	21	2	38	4	12	1	126	13	238	24
−10 to − 6	181	18	34	3	119	12	48	5	150	15	91	9	308	31	255	25
− 5 to 0	178	18	90	9	183	18	130	13	374	37	291	29	373	37	389	39
1 to 5	156	16	162	16	164	16	154	15	317	32	319	32	120	12	37	4
6 to 10	138	14	122	12	154	15	155	16	73	7	211	21	25	2	16	2
11 to 15	104	10	145	15	135	14	138	14	18	2	41	4	6	1	4	0
16 to 20	56	6	142	14	73	7	130	13	6	1	11	1	6	1	5	0
21 to 25	21	2	118	12	35	4	93	9	6	1	3	1	0	0	0	0
26 or more	15	1	132	13	26	3	89	9	2	0	7	1	2	0	2	0
	999	100	999	100	999	100	999	100	999	100	999	100	999	100	999	100
PROCESS EQUIPMENT																
−26 or less	46	8	13	2	31	6	17	3	4	1	4	1	5	1	5	1
−25 to −21	98	18	13	2	73	13	19	4	1	0	1	0	9	2	10	2
−20 to −16	123	23	46	9	102	19	76	14	13	2	6	1	49	9	108	20
−15 to −11	100	19	88	16	113	21	94	17	105	20	30	5	113	21	67	13
−10 to − 6	52	10	110	20	76	14	113	21	59	11	120	22	28	5	33	6
− 5 to 0	65	12	110	20	55	10	79	15	50	9	38	7	165	31	213	39
1 to 5	31	6	40	8	50	9	45	8	178	33	113	21	120	22	66	12
6 to 10	5	1	52	10	17	3	45	8	87	16	128	24	33	6	27	5
11 to 15	11	2	37	7	8	2	28	5	26	5	63	12	12	2	6	1
16 to 20	3	0	9	2	8	2	5	1	11	2	26	5	1	0	0	0
21 to 25	3	0	7	1	2	0	11	2	1	0	6	1	2	0	2	0
26 or more	5	1	17	3	7	1	10	2	7	1	7	1	5	1	5	1
	542	100	542	100	542	100	542	100	542	100	542	100	542	100	542	100
FOOD SERVICE EQUIPMENT																
−26 or less	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
−25 to −21	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
−20 to −16	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0
−15 to −11	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
−10 to − 6	8	3	0	0	3	1	0	0	0	0	0	0	2	1	0	0
− 5 to 0	20	8	1	0	21	8	3	1	3	1	2	1	62	23	3	1
1 to 5	34	13	11	4	23	9	19	7	85	32	9	3	130	49	85	32
6 to 10	63	24	14	6	47	18	8	3	113	43	113	42	41	15	113	43
11 to 15	48	18	24	9	51	19	33	13	35	13	87	33	19	7	35	13
16 to 20	23	9	54	20	38	14	56	21	18	7	28	10	10	4	18	7
21 to 25	16	6	42	16	18	7	42	16	9	3	15	6	2	1	9	3
26 or more	52	19	119	45	64	24	104	39	3	1	12	5	0	0	3	1
	266	100	266	100	266	100	266	100	266	100	266	100	266	100	266	100

and the degree of asset aggregation to be reported.

Since the data used to construct the PPI are confidential, it is not possible to quantify the amount of the measurement error due to each potential source of error. Various asset classifications exhibited understatements or overstatements of new current cost which may be due to one or a combination of sources. Product mix errors appeared to be the dominant factor for Electrical and Miscellaneous Equipment; pricing errors for General Purpose and Food Service Equipment; and inadequate adjustments for quality change for Machine Tools

TABLE 5

PERCENTAGE DEVIATIONS OF PPI ESTIMATES FROM THE CURRENT ORDER PRICE OF THE ASSET
NO APPARENT CONSISTENT DOMINANCE

	Seven-Year-Old Assets (1973–1980)								*Four-Year-Old Assets (1976–1980)*							
	PPI_1		*PPI_2*		*PPI_3*		*PPI_4*		*PPI_1*		*PPI_2*		*PPI_3*		*PPI_4*	
Frequency Distribution of Percentage Deviations	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %*	*Abs. No.*	*Rel. %.*
HEATING, AIR CONDITIONING AND REFRIGERATION EQUIPMENT																
−26 or less	11	4	6	2	11	3	7	2	0	0	0	0	0	0	0	0
−25 to −21	11	4	2	1	5	2	4	1	0	0	0	0	0	0	0	0
−20 to −16	7	2	6	2	10	3	5	2	0	0	0	0	0	0	0	0
−15 to −11	14	4	9	3	10	3	10	3	0	0	0	0	0	0	0	0
−10 to − 6	27	9	6	2	18	6	10	3	0	0	0	0	1	0	7	2
− 5 to 0	61	20	17	5	53	17	19	6	8	3	1	0	109	36	226	73
1 to 5	41	13	27	9	46	15	37	12	168	54	25	8	173	56	61	20
6 to 10	36	12	52	17	32	10	54	18	112	36	207	67	19	6	9	3
11 to 15	31	10	31	10	33	11	32	10	14	5	62	20	7	2	7	2
16 to 20	25	8	34	11	34	11	33	11	7	2	8	3	1	0	0	0
21 to 25	5	1	29	9	13	4	28	9	1	0	7	2	0	0	0	0
26 or more	41	13	91	29	45	15	71	23	0	0	0	0	0	0	0	0
	310	100	310	100	310	100	310	100	310	100	310	100	310	100	310	100
FOUNDRY AND HEAT TREATING EQUIPMENT																
−26 or less	62	35	11	6	54	30	5	3	0	0	0	0	0	0	0	0
−25 to −21	27	15	36	20	28	16	38	21	0	0	0	0	0	0	0	0
−20 to −16	17	10	25	14	19	11	27	15	0	0	0	0	0	0	0	0
−15 to −11	27	15	21	12	19	11	19	11	0	0	0	0	0	0	0	0
−10 to − 6	24	14	15	9	25	14	15	9	0	0	0	0	8	4	0	0
− 5 to 0	11	6	27	15	16	9	27	15	19	11	7	4	77	44	8	5
1 to 5	4	2	22	12	9	5	26	15	77	43	41	23	74	42	52	29
6 to 10	2	1	8	5	3	2	4	2	65	37	87	49	12	7	89	50
11 to 15	0	0	6	3	1	0	9	5	10	5	32	18	5	3	18	10
16 to 20	2	1	2	1	0	0	2	1	5	3	5	3	0	0	6	3
21 to 25	1	1	1	1	3	2	2	1	0	0	4	2	0	0	3	2
26 or more	0	0	3	2	0	0	3	2	1	1	1	1	1	0	1	1
	177	100	177	100	177	100	177	100	177	100	177	100	177	100	177	100

and Special Industry Equipment. However, in general, the measurement error tends to be an overstatement of new current cost. Thus, an inadequate adjustment for quality change in the PPI may be the major source of error.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

The results of this study contribute to our understanding of the sign, magnitude, and sources of the *potential* measurement error in the current cost data required to be disclosed by Statement #33. In a strict sense, the results of this study are limited to: the source of the price data, the PPI examined, standard specifications of industrial machinery and equipment, and four-year-old and seven-year-old assets. Mainly, the results are dependent upon the *assumption* that the current order prices, matched by standard engineering specifications, are more accurate than the sellers' realization prices used in the PPI.[14]

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[14] Lim and Sunder [1986] analytically conclude that the relative properties of valuation rules are functions of the economic environments in which the rules are applied. Thus, additional research might be conducted for other economic environments, price data bases, categories of assets, and ages of assets to ascertain whether these results are situation-specific to industrial machinery and equipment or are representative of the universe of commodities contained in the PPI.

Also, the results are limited to the estimation of the current cost of individual assets. Hence, the study does not address the agency question of managerial choice of price index and level of asset aggregation for actual firms. However, the results may be applied to any firm-specific asset mix by sampling from the individual asset error metrics in the designated firm-specific proportions for each homogeneous asset classification. Future research might gather data on the specificity of the index applied and the level of asset aggregation chosen by various firms to examine the potential measurement error for the diverse levels of asset aggregation reported by various firms.

Finally, the results of this study may facilitate future research about the usefulness of current cost data. Specifically, failure to find an effect on decisions (assuming no potential defects in the research design) implies either that measurement errors exceed the potential information content of the current cost data or that users are systematically ignoring potentially relevant information [Beaver and Landsman, 1983]. This study provides researchers with statistical data about the sign and magnitude of *potential* measurement errors in PPI estimates of current cost data which might be considered when conducting aggregate studies of the incremental information content with respect to security prices or behavioral studies of the effects of current cost data on individual decision-making. In other words, the alleged lack of usefulness of current cost data may be due to concerns about the accuracy of the Statement #33 disclosures.

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The Construction of a Rule-Based Expert System as a Method for Studying Materiality Judgments

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ABSTRACT: This paper describes the construction of an expert system for making planning-stage materiality judgments. The purpose of the study was to investigate how various types of quantitative and qualitative information influence those judgments. A rule-based expert system was built as a vehicle for this descriptive research because its use of If-Then rules to represent domain knowledge makes both the role played by various pieces of information and the reason for using that information explicit. The system's judgment model breaks down the materiality judgment process into two separate decisions: (1) a choice of the appropriate base for calculating materiality and (2) the selection of a percentage rate to multiply by that base. Examination of the rules used by the system indicates that information about (a) the nature of the client, (b) future plans of the client, and (c) perceptions of the needs of financial statement users influences the choice of a materiality base. Information about the intended use of the financial statements and the nature of the audit engagement affects the selection of the percentage rate.

MATERIALITY judgments play a fundamental role in the audit process, influencing both the planning of audit procedures and the evaluation of audit evidence. Nevertheless, there are no authoritative guidelines for making those judgments. The Financial Accounting Standards Board (FASB) considered establishing such guidelines and issued a Discussion Memorandum on the topic [FASB, 1975], but eventually decided that "no general standards of materiality could be formulated to take into account all the considerations that enter into an experienced human judgment" [FASB, 1980, para. 131]. Statement on Auditing Standards (SAS) 47 makes a similar claim:

> materiality judgments are made in light of surrounding circumstances and necessarily involve both quantitative and qualitative considerations [AICPA, 1983, para. 6].

The important role played by materiality judgments in the audit process, coupled with the lack of authoritative guidance for making those judgments, has produced a large body of research on

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the topic. Holstrum and Messier [1982] review that research and conclude, however, that the results do not provide any "definitive comprehensive implications for audit practice or policy formulation" [p. 59]. They point out that previous research has concentrated on materiality judgments for public, industrial companies and suggest that future research needs to investigate the effects that the nature of the client and its industry classification have on materiality judgments. Moreover, they note that most previous studies have examined materiality judgments in the context of evaluating audit evidence and call for future research to address the role of materiality in the planning stages of the audit process.

This paper reports on the construction of a rule-based expert system (RBES) as a means of conducting descriptive research on planning-stage materiality judgments. Researchers in the field of artificial intelligence have long recognized that building such systems is a means for learning more about how particular judgments are made.

> The aim here [in building knowledge-based computer programs such as RBESs] is thus not simply to build a program that exhibits a certain specified behavior, but *to use the program construction process itself as a way of explicating knowledge in the field, and to use the program text as a means of expression of many forms of knowledge about the task and its solution* [Davis and Lenat, 1982, p. 471].

The program text of an RBES consists of a set of If-Then rules that represent the knowledge used to make a particular judgment. The conclusions of the rules specify an action to take or an inference to make; the premises specify the situations in which it is appropriate to use that rule. Thus, the rules used to make a specific judgment describe not only what information was used to reach that decision but also why that particular information was used.

The knowledge used by AUDITPLANNER (the name given to the RBES built in this study) to make planning-stage materiality judgments was acquired, in large part, by having an audit partner make those judgments for actual clients. No constraints were placed upon the nature of the information that was used to make those judgments. This ability to study judgment behavior in its natural setting makes the construction of an RBES a particularly attractive method for conducting descriptive research, because of empirical research evidence that seemingly minor changes in either the content or setting of a decision task can significantly affect the observed behavior [Adelman, 1981; Cox and Griggs, 1982; Ebbesen and Konecni, 1980; Einhorn and Hogarth, 1982; Hayes and Simon, 1977; Hoch and Tschirgi, 1983; Kahneman and Tversky, 1979].

The remainder of this paper is organized in four sections. The first section reviews prior research on materiality and provides some background on planning-stage materiality judgments. The second section describes the process followed to build AUDITPLANNER. The third section discusses the judgment model used by AUDITPLANNER. Some of the rules contained in the system are presented to explicitly illustrate how specific information is used to determine materiality. The last section summarizes the findings of this study, discusses its limitations, and explores implications for future research.

BACKGROUND

SAS 47 states that the auditor should consider materiality "both in (a) planning the audit and designing auditing procedures and (b) evaluating whether the financial statements taken as a whole are presented fairly in conformity with generally accepted accounting principles" [AICPA, 1983, para. 8]. Planning-stage materiality judgments influence decisions about the nature, timing, and extent of audit procedures. The purpose is to ensure that adequate evidence will be collected so that an opinion on the fairness of presentation of the financial statements can be expressed. The evaluation of audit evidence then involves a consideration of materiality to determine the effect on the overall fairness of presentation of any errors that may have been uncovered by the audit tests and procedures.

SAS 47 points out that the two materiality judgments may not be the same, because each is made at a different point in time and, therefore, is based on different information:

> Assuming, theoretically, that the auditor's judgment about materiality at the planning stage was based on the same information available to him at the evaluation stage, materiality for planning and evaluation purposes would be the same. However, it is ordinarily not feasible . . . to anticipate all of the circumstances that may ultimately influence his [materiality] judgment . . . Thus, his preliminary materiality judgment ordinarily will differ from his judgment about materiality used in evaluating the audit findings [AICPA, 1983, para. 15].

One of the more important pieces of additional information available at the evaluation stage is information about the nature of the item that may be in error.

> The answer to that question [Is the item material?] will usually be affected by the nature of the item; items too small to be thought material if they result from routine transactions may be considered material if they arise in abnormal circumstances [FASB, 1980, para. 123].

The results of previous empirical research tend to support the discussions of materiality in the authoritative literature cited above. Both the studies that used controlled experiments and those using questionnaire cases found that the percentage effect of the item on income was the single most important quantitative factor influencing those judgments [Boatsman and Robertson, 1974; Pattillo and Siebel, 1974; Pattillo, 1975, 1976; Moriarity and Barron, 1976; Firth, 1979; Messier, 1983]. Respondents to the surveys, however, indicated that information about the nature of the item (e.g., whether it involved a contingency or an extraordinary item, etc.) was also an important determinant of materiality. Although only one of the studies using controlled experiments varied the nature of the item, the results indicated that that factor was indeed a significant determinant of materiality. Boatsman and Robertson [1974] report that a simple model based solely on a percentage of income rule accurately classified 65 percent of the subjects' judgments; the addition of two more variables—one to represent the nature of the item, the other to represent the degree of perceived risk in the audit—raised the model's predictive accuracy to 84 percent.

Holstrum and Messier [1982] point out another important implication of previous research results:

> [I]n the absence of clear materiality guidelines, auditors' materiality judgments demonstrated considerable diversity and lack of consensus [p. 59].

That result was found when comparing auditors from large national firms with auditors from small firms [Woolsey, 1973; Messier, 1983]; among auditors from different large firms [Firth, 1979; Lewis, 1980; Mayper, 1982]; and even among auditors within the same firm [Moriarity and Barron, 1979].

There is also some evidence that auditors' attitudes toward risk may affect their materiality judgments and may also be partially responsible for a lack of consensus about materiality. Boatsman and Robertson [1974] found that including a variable to represent the perceived degree of risk in the audit improved the predictive accuracy of their judgment model. Ward [1976] found a lack of consensus among auditors concerning the effects of their failure to find a material error. Newton [1977] examined how the uncertainty surrounding the resolution of an item affected materiality judgments; 55 percent of the audit partners in that study were classified as being risk-averse, but 34 percent were classified as being risk-seeking.

The studies reviewed thus far all examined the materiality judgments made when evaluating audit evidence. Moriarity and Barron [1979] conducted the only previous empirical study of planning-stage materiality judgments. Five audit partners from the same public accounting firm were given summarized financial statements for 30 hypothetical companies and were asked to determine the overall materiality level to be used in planning the audit. Five variables were experimentally manipulated: (1) net income, (2) earnings trend, (3) total assets, (4) number of shares outstanding, and (5) the debt-to-equity ratio. Net income was the most important factor for four of the partners, with total assets being most important for one partner. Either earnings trend or total assets were second in importance for each partner. There was also some evidence of a break-even effect: the importance of net income declined as it approached zero.

Moriarity and Barron did not provide their subjects with background information about the client such as its industry classification, management objectives, and the identity of the prospective users of its financial statements. In post-experimental debriefings the partners complained about the artificial nature of the cases due to the lack of that information. Indeed, discussions of materiality in SAS 47 indicate that such information is important to the determination of materiality:

> The auditor's consideration of materiality is a matter of professional judgment and is influenced by his perception of the needs of a reasonable person who will rely on the financial statements [AICPA, 1983, para. 6].
>
> An amount that is material to the financial statements of one entity may not be material to the financial statements of another entity of a different size or nature [AICPA, 1983, para. 5].

In summary, previous research on materiality indicates that the percentage effect of the item on income is the single most important determinant of materiality when evaluating audit evidence. Similarly, the lone empirical study of planning-stage materiality judgments found the amount of net income to be the most important determinant of those judgments. When evaluating audit evidence, however, information about the nature of the item is also an important factor influencing materiality judgments. Similarly, the comments of the participants in the Moriarity and Barron [1979] study, together with the statements in SAS 47, suggest that information about the nature of the client is an important factor influencing planning-stage materiality judgments. The purpose of this study is to build a model which explicitly illustrates how such information is used. The next section describes the process used to build that model.

CONSTRUCTION OF AUDITPLANNER

An RBES consists of three components: (1) a knowledge base, which contains the If-Then rules that represent the domain knowledge used to make a particular judgment; (2) an inference engine, or control strategy, which guides the application of those rules; and (3) a working memory, which serves as a scratch-pad to keep track of the goals being pursued and the progress made toward their attainment.[1] A number of software tools (called shells) are available to facilitate the construction of an RBES. Those shells consist of an inference engine, an empty knowledge base, and the functions needed to create and maintain the knowledge base. Consequently, the use of one of these shells permits the researcher to concentrate on the acquisition and organization of the knowledge used to make the judgment being studied, rather than on writing the computer code to manipulate that knowledge. The remainder of this section describes the steps involved in the construction of AUDITPLANNER: (1) the choice of a particular software tool, (2) the selection of a subject, and (3) the development and refinement of the knowledge base.

Selection of a Software Tool

The shell program EMYCIN [Van Melle et al., 1981] was used to build AUDITPLANNER. EMYCIN is based on the expert system MYCIN, which was designed to diagnose infectious blood diseases [Shortliffe, 1976; Buchanan and Shortliffe, 1984]. EMYCIN has been used successfully to build a number of RBESs to perform such tasks as (1) diagnosing lung diseases, (2) assisting engineers in the selection of tests to analyze the stress characteristics of physical structures, (3) performing psychoanalysis, (4) interpreting data about the geological characteristics of oil wells, and (5) identifying the causes of telecommunications systems failures [Van Melle et al., 1981]. EMYCIN has also been used in two accounting applications of RBESs that (1) plan for individual estate taxes [Michaelsen, 1982, 1984] and (2) evaluate the quality of internal controls [Gal, 1985].

EMYCIN-based systems function as consultants: the user is asked a series of questions and the RBES makes its recommendations based on the answers to those questions. EMYCIN uses a backward-chaining control strategy which involves reasoning back from the desired goal of the session (in the case of AUDITPLANNER, a planning-stage materiality judgment) to the objective facts that are needed to support that decision (i.e., specific characteristics of the client being audited). Questions are asked to obtain the objective data that would support a particular chain of deductive reasoning; the result is a focused dialogue that is easy to follow and understand. Appendix A presents an example of one session with AUDITPLANNER.

Selection of a Subject

Eleven major accounting firms were contacted and asked to provide those portions of their audit manuals that discuss materiality. Ten of the firms complied with that request. Interviews were arranged with four firms whose audit manuals indicated that (1) they regularly made and quantified planning-stage materiality judgments and (2) quantification of materiality resulted from the exercise of the individual auditor's professional judgment and not from the application of a specific mathematical formula to all clients. During the interviews additional questions were asked about how the planning-stage materiality judgments were made. In addition, the substantial time commitment that would be required of the participant in this research was explained.

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[1] For a more detailed discussion of RBESs, the interested reader is referred to any of the following general texts: Hayes-Roth, Waterman, and Lenat [1983], Buchanan and Shortliffe [1984], Harmon and King [1985], or Waterman [1986].

An audit partner at one firm agreed to participate in the study, but requested anonymity because of the sensitive nature of materiality judgments and the current litigious environment facing practitioners. The partner had experience in making planning-stage materiality judgments for a wide variety of clients, with particular emphasis on finance companies and health care organizations. Cushing and Loebbecke [1986] develop a taxonomy for classifying audit firms in terms of the degree of structure in their audit methodology. The firm to which the partner belonged would be classified as falling into one of the two more structured categories in that taxonomy.

One limitation of the tools currently available to build RBESs is that they cannot effectively deal with conflicting judgment strategies. Consequently, to ensure consistency the rules contained in AUDITPLANNER were acquired primarily from this one audit partner. After the knowledge base was developed, however, six other auditors in the same firm used AUDITPLANNER and suggested further refinements.

Development and Refinement of AUDITPLANNER's Knowledge Base

The first step in building AUDITPLANNER involved the construction of an initial working version, or prototype, of the system. That prototype contained rules gleaned from the discussions of materiality in the firm's audit manuals. The use of such textbook knowledge, if available, is an efficient means for building the prototype's knowledge base and has been successfully incorporated in previous EMYCIN-based systems [Van Melle et al., 1981; Michaelsen, 1982, 1984].

The working prototype system provided the auditor with a tool that could be used to make, albeit rather crudely, planning-stage materiality judgments for actual clients. The majority of the rules included in AUDITPLANNER's knowledge base were then acquired during interactive sessions with the auditor. The audit partner would use the current version of AUDITPLANNER to make planning-stage materiality judgments (i.e., set an overall materiality level for use in planning the audit) for actual clients that had been dealt with in the past. Such use enabled the auditor to identify areas where AUDITPLANNER was not performing satisfactorily (i.e., it was reaching the "wrong" conclusions or following an inappropriate line of reasoning).

Whenever the auditor disagreed with AUDITPLANNER, EMYCIN's interrogation facilities were then used to identify the rules that were the cause of that disagreement. Those facilities permitted the asking of How and Why questions to determine what AUDITPLANNER was doing, and why, at a particular point in time. Such questions could be asked either during a consultation or after AUDITPLANNER had made its recommendations. Appendix B presents an example of how those capabilities could be used during a consultation.

Once the cause of the disagreement was identified, the researcher asked the audit partner to explain why the particu-

TABLE 1
CHARACTERISTICS OF CLIENTS USED TO EVALUATE AUDITPLANNER

Client	*Characteristics*
Machine tool manufacturer	involved in a major acquisition of a subsidiary
Machine tool manufacturer	a subsidiary of a foreign parent
Insurance company	subsidiary company
Restaurant	normal, profitable company
Automobile dealership	normal, profitable company
School district	nonprofit organization
Boy Scout Council	nonprofit organization
Computer manufacturer	normal, profitable company
Retail supermarket	normal, profitable company
Retail supermarket	suffered a loss for the year
Common carrier—trucking	subject of litigation and also involved in several large acquisitions
Common carrier—trucking	subject of an inquiry by a regulatory agency
Microcomputer retailer	private entity about to go public

lar rules in question were not appropriate in this situation and to explain how the judgment should have been made. The suggested modifications were written down and AUDITPLANNER's knowledge base was modified later. At the next interactive session the audit partner used the revised version of the system on the clients for which it had previously made the correct decisions and also on those for which it had erred, to ensure that the modifications worked correctly and did not have any unintended side effects. The revised system was then used on additional clients.

Each interactive session lasted about four hours and took place about once every four weeks. After five such sessions, involving approximately 20 different clients, the audit partner indicated that AUDITPLANNER was performing satisfactorily. Six other auditors (three managers and three seniors) from the same firm were then asked to use AUDITPLANNER to make planning-stage materiality judgments for some of their clients. Each auditor had at least one and one-half years experience in making such judgments. A representative, rather than random, sample of clients was selected to provide some measure of the breadth of AUDITPLANNER's competence. Table 1 describes the 13 clients that were selected.

Each of the six auditors used AUDITPLANNER to make a planning-stage materiality judgment for the clients he had selected, and then indicated whether AUDITPLANNER's recommendation was acceptable. After they had used AUDITPLANNER for their clients, each auditor was also given a questionnaire to fill out and return later that day. A copy of the questionnaire is included in Appendix C.

AUDITPLANNER's recommenda-

TABLE 2
FREQUENCY DISTRIBUTION OF RESPONSES TO QUESTIONNAIRE

Question	*SA*	*A*	*N*	*D*	*SD*
7. AUDITPLANNER is not competent	0	1	0	3	2
22. AUDITPLANNER is competent	0	4	2	0	0
8. Would accept AUDITPLANNER's recommendations	0	3	1	2	0
24. Would approach the materiality judgment in a different manner than did AUDITPLANNER	0	1	0	5	0
6. Would want to use AUDITPLANNER as a decision aid	0	6	0	0	0
14. Would permit subordinates to use AUDITPLANNER as a decision aid	0	5	0	0	1
18. Would not want subordinates to use AUDITPLANNER as a training device	0	0	1	4	1
3. AUDITPLANNER asked irrelevant questions	0	0	0	3	3
19. AUDITPLANNER's logic easy to follow	2	4	0	0	0
15. AUDITPLANNER's logic hard to follow	0	0	0	3	3

Key: SA = Strongly Agree
A = Agree
N = Don't Know or Neutral
D = Disagree
SD = Strongly Disagree

tions were considered to be acceptable for eight of the 13 clients that were tested. Table 2 presents the results of the questionnaire items that dealt with AUDITPLANNER's competency.[2]

The responses to the questionnaire indicate that the six auditors generally agreed that AUDITPLANNER was competent. Not all of AUDITPLANNER's recommendations were accepted, however. One reason may be that one of the six auditors indicated that he would definitely take a different approach to determining materiality than that used by AUDITPLANNER. Another factor may be AUDITPLANNER's conservatism: it almost always recommended a materiality level that was lower than that previously selected by the auditors.

In summary, the responses of the six auditors indicate that AUDITPLANNER possesses a general level of competency for making planning-stage materiality judgments, although additional work would be required before it could actually be used as a decision aid. The purpose of the present study, however, is not to build a decision aid but to build an RBES as a means to learn more about how various types of information affect the planning-stage materiality judgments. The next section does that by describing the judgment model used by AUDITPLANNER.

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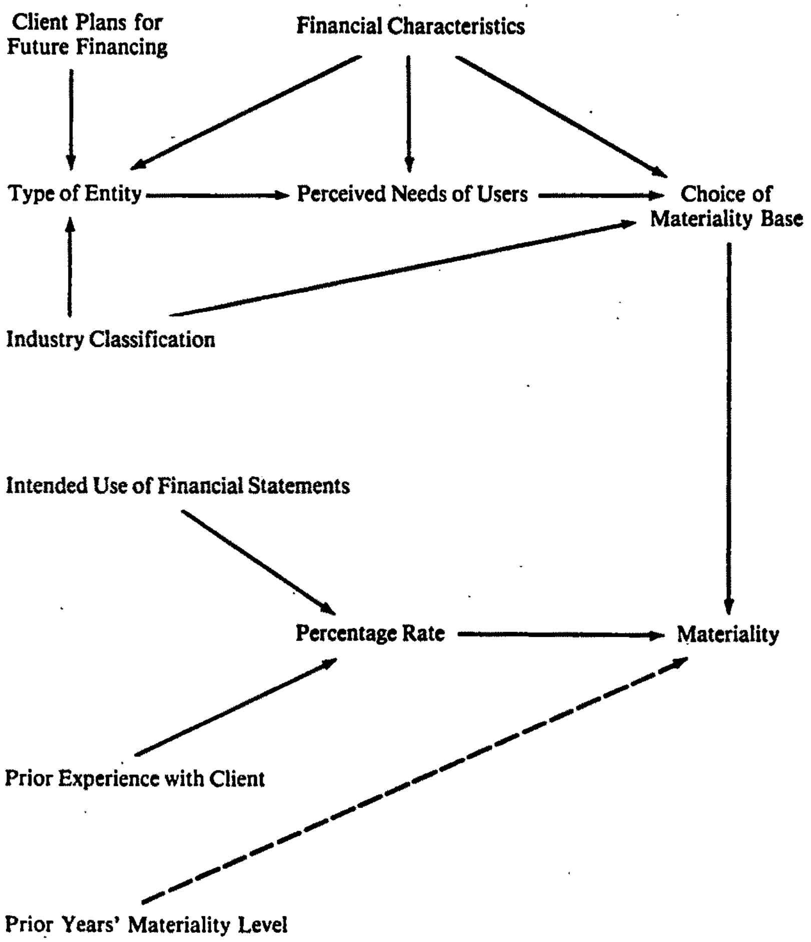
[2] The other questions were included in the questionnaire to examine the auditors' reactions to the use of RBESs and to obtain feedback about its future development. Those responses are not discussed here because they are not directly relevant to this study.

FIGURE 1
AUDITPLANNER's JUDGMENT MODEL


Client Plans for Future Financing
Financial Characteristics
Type of Entity
Perceived Needs of Users
Choice of Materiality Base
Industry Classification
Intended Use of Financial Statements
Percentage Rate
Materiality
Prior Experience with Client
Prior Years' Materiality Level

AUDITPLANNER's JUDGMENT MODEL

AUDITPLANNER's knowledge base consists of 95 rules which it uses to make planning-stage materiality judgments. The general strategy followed by AUDITPLANNER is presented in Figure 1. Eight factors were found to influence planning-stage materiality judgments: (1) client plans for future financing, (2) financial characteristics of the client, (3) the client's industry classification, (4) the type of entity that the client is, (5) the perceived needs of the users of the client's financial statements, (6) the intended use of the client's financial statements, (7) prior experiences with the client, and (8) prior years' materiality levels. The first five factors affect the choice of the appropriate base for calculating materiality; factors 6 and 7 influence the selection of a percentage rate to multiply by that base, and the last factor may be used to modify the resulting calculation. The remainder of this section presents some of the rules used by

AUDITPLANNER to show explicitly how each of these factors affects planning-stage materiality. The discussion is organized around the major sub-decisions: (1) the choice of a base for calculating materiality, (2) the selection of a percentage rate, and (3) the actual calculation of an overall planning-stage materiality level.

Choice of Materiality Base

The choice of a materiality base is influenced by decisions that determine what type of entity is being audited and the perceived needs of the users of the client's financial statements. Each of these decisions is discussed in turn.

Type of Entity. Figure 1 shows that information about the client's (1) plans for future financing, (2) financial characteristics, and (3) industry classification are all used to decide what type of entity the client is. The basic rules involve the use of financial characteristics to decide whether the client is a public or private entity:

If
1. the client has publicly traded debt or equity securities *or*
2. the client has restrictive debt covenants that are measured by or depend on periodic financial statement amounts or ratios that involve results of operations,

Then the client is a public entity.[3]

Should neither of the premises be true, AUDITPLANNER concludes that it is highly likely that the client is a private entity. That conclusion, however, is made with less than absolute certainty; information about the client's plans for future financing (if any) and industry classification may indicate that the client should be treated as a public entity for purposes of calculating materiality:

If
1. it is likely that the client is a private entity *and*
2. A: the client is filing with a regulatory agency in preparation for the sale of its securities in a public market *or*
   B: the client does intend to go public within the next two or three years,

Then the client is a public entity.

If the client's main line of business or industry classification is insurance,

Then the client is a public entity (for purposes of calculating materiality).

Gibbins and Wolf [1982] found that client plans for future financing were an important factor in planning the audit; the first rule above illustrates how AUDITPLANNER uses that information. The second rule illustrates one way in which AUDITPLANNER uses information about the client's industry classification. Note that both of these rules have an indirect effect on materiality (in fact, both appear quite early in the chain of reasoning that results in a materiality judgment).

Perceived Needs of Financial Statement Users. SAS 47 states that the auditor's perception of the needs of financial statement users is one of the factors that influences materiality judgments. AUDITPLANNER uses information about the type of entity that a client is and about certain financial characteristics of the client to infer the likely interests of the users of the client's financial statements:

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[3] Most of AUDITPLANNER's rules have a certainty factor of one associated with their conclusions; that is, the conclusions definitely follow from the premises. Those rules which have a certainty factor of less than one are translated here with the phrase "it is highly likely" in their conclusion, followed by a decimal number representing the degree of certainty that the conclusion follows from the premises. Certainty factors are not Bayesian probabilities, but rather, resemble belief functions. For more information about certainty factors, the interested reader is referred to Shortliffe and Buchanan [1975].

If
1. the client is a public entity *and*
2. there is not any significant concern about the client's liquidity or solvency,

Then the principal users of the client's financial statements can be assumed to be interested primarily in the results of current operations.

If
1. the client is a public entity *and*
2. there is significant concern about the client's liquidity or solvency,

Then the principal users of the client's financial statements can be assumed to be interested primarily in measures of financial position.

If the client is a private entity,
Then the principal users of the client's financial statements can be assumed to be interested primarily in measures of financial position.

Choice of Materiality Base. Inferences about the interests of financial statement users guide the choice of a base for calculating materiality. The following rules show how AUDITPLANNER makes that choice:

If
1. the principal users of the client's financial statements can be assumed to be interested primarily in the results of current operations *and*
2. income from continuing operations is greater than zero,

Then the materiality judgment should be based on the amount of income from continuing operations.

If
1. the principal users of the client's financial statements can be assumed to be interested primarily in measures of financial position *and*
2. the amount of current assets is greater than the amount of owners' equity,

Then the materiality judgment should be based on the amount of owners' equity.

If
1. the principal users of the client's financial statements can be assumed to be interested primarily in the results of current operations *and*
2. income from continuing operations is less than or equal to zero *and*
3. last year's income from continuing operations was greater than zero *and*
4. income from continuing operations has been at or below zero no more than once during the preceding three years,

Then the materiality judgment should be based on the trend in past earnings.

The last rule illustrates the breakeven phenomenon reported by Moriarity and Barron [1979]. Note, however, that earnings trend is used as the base for calculating materiality only when there have not been recurring losses. Should either premise 3 or premise 4 not hold, AUDITPLANNER would use another rule that bases materiality on the amount of owners' equity. The rationale is that in the case of continuing losses, financial statement users begin to become concerned about the long-run liquidity of the company. The rather limited situations described by the above rule for using earnings trend probably explain the findings of previous research that it is a secondary factor of only marginal significance for predicting materiality judgments.

The authoritative literature states that the client's industry classification may affect materiality judgments [AICPA, 1979, para. 150.04]. We have already seen one way that AUDITPLANNER uses such information; the following rule illustrates another, more direct, use of that information:

If 1. the client is a financial institution *and*
   2. the product of stockholders' equity and the materiality percentage rate is greater than the result obtained by dividing income from continuing operations by the average rate of return on the investment portfolio,
Then set the materiality level for the investment portfolio to be equal to the amount of income from continuing operations divided by the average rate of return on that portfolio.

The rationale for this rule is that investment portfolios of most financial institutions are so large that use of the overall materiality level would lead to too much testing of that item.

Selection of a Percentage Rate

Figure 1 indicates that AUDITPLANNER uses information about the intended uses of the client's financial statements and about prior experience with the client to select the percentage rate for calculating materiality. The following rule shows how the latter information is used:

If 1. this is the first time that we have audited the client *and*
   2. A: this is the first time that the client has ever been audited *or*
      B: the client's previous auditors left because of a dispute with the client,
Then the materiality level needs to be reduced below what it would otherwise be calculated to be because of the increased risk and uncertainty reflected in this situation.

This rule provides an explicit example of how audit risk and materiality interact. The rationale for this rule is that on initial audits there is no track record to assist in the evaluation of the quality of internal controls. Moreover, if the previous auditors left because of a dispute with the client, that is probably an indication that there may be certain areas which will require special attention.

Certain types of situations represent increased business risk. The audit partner who participated in this study indicated that in such situations additional testing beyond that required by GAAS is appropriate. AUDITPLANNER responds to situations representing increased business risk by reducing its recommended percentage rate for calculating materiality. The following rule shows how information about the intended use of the client's financial statements influences that decision:

If 1. the financial statements are not going to be used in connection with a public offering of the client's securities *and*

2. the financial statements are not going to be used in connection with a transfer of interests in the client *and*
3. the financial statements are not going to be used in connection with a contest for control of the client *and*
4. the financial statements are not going to be used to settle some outstanding litigation in which the client is involved *and*
5. the financial statements are not going to be used in connection with an inquiry by a regulatory agency *and*
6. the client is not in violation of, and is not likely to be found to be in violation of, restrictive debt covenants relating to the results of continuing operations,

Then a percentage rate of five percent should be used to calculate materiality.

Should any of the premises in this rule not hold, it would indicate that there is an increased business risk which may call for the use of a lower percentage rate in calculating materiality.[4]

Calculation of Overall Materiality Level

Figure 1 indicates that the materiality base is multiplied by the percentage rate to establish the overall materiality level for use in planning the audit. Prior years' materiality levels may also influence that calculation. The audit partner indicated that *after* a materiality level has been calculated, it is compared to subjective bounds which represent both an upper and lower limit to acceptable materiality levels. The upper bound represents the auditor's perception of an amount that most users would consider, *prima facie*, to be material; the lower level represents an amount that would result in an uneconomical amount of testing.[5] The following rules illustrate what happens when the materiality level is too high:

If
1. the overall materiality level is deemed to be too high *and*
2. this year's calculated materiality level is greater than that used last year,

Then it is very likely that this year's materiality level should be set at an amount that is 20 percent above the level used last year.

If
1. the overall materiality level is deemed to be too high *and*
2. this year's calculated materiality level is less than that used last year,

Then it is very likely that this year's materiality level should be used as calculated.

Together, these rules show a conservative bias. On the other hand, if the materiality level is deemed to be too low, it is reset at a level equal to the auditor's lower bound for economical testing.

CONCLUSION

This study demonstrates the feasibility of studying audit judgments in natural settings. An RBES was built as a means of studying planning-stage materiality judgments. Those judgments were seen to involve two separate sub-decisions: (1) the choice of an appropriate base for calculating materiality and (2) the selection of a percentage rate to multiply by that base. The rules presented in the previous section illustrate explicitly how various aspects of the decision setting affect each of those decisions and materiality.

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[4] The partner's concern about the sensitive nature of the situations in which a lower percentage rate is used precludes the publication of those rules that specify the exact rates to use in those situations.

[5] The actual levels of these bounds would depend on the types and size of clients normally audited and would, therefore, probably vary from one auditor to another.

The choice of the base for calculating materiality was shown to depend on the perceived needs of financial statement users and objective characteristics of the client. The choice of a percentage rate, on the other hand, was much more subjective. It depended on both the identification of specific situations representing increased risk and the auditor's preferred response to that risk.

One limitation of this study is that AUDITPLANNER's knowledge base reflects primarily the judgment model of one audit partner. This clearly limits the generalizability of the findings. The primary reason for using one subject was the inability of current tools for building RBESs to deal with conflicting judgment strategies, and previous research had indicated a lack of consensus among auditors concerning their materiality judgments. The development of individual-specific models may, however, play an important role in understanding that lack of consensus:

> Since intelligent systems are programmable [i.e., they adapt to the demands of the task environment], we must expect to find different systems (even of the same species) using quite different strategies to perform the same task. I am not aware that any theorems have been proved about the uniqueness of good, or even best, strategies. Thus, we must expect to find strategy differences not only between systems at different skill levels, but even between experts.
>
> Hence, research on the performance of adaptive systems must take on a taxonomic, even a sociological aspect. We have a great deal to learn about the variety of strategies, and we should neither disdain nor shirk the painstaking, sometimes pedestrian, tasks of describing that variety. That substrate is as necessary to us as the taxonomic substrate has been to modern biology [Simon, 1980, p. 42].

The development of a taxonomy of materiality judgment models should identify the commonalities and differences between auditors in their approach to making materiality judgments. This study represents but one step toward developing such a taxonomy. Much additional work is needed. Similar models need to be built for individuals both in the same firm and from different firms. Eventually, such a taxonomy may enable us to identify the bases for establishing general guidelines for determining materiality.

APPENDIX A

A SAMPLE SESSION WITH AUDITPLANNER

This is an example of a session with AUDITPLANNER. Each session begins with an introductory statement which is followed by a series of questions. The same sequence of questions would *not* be asked for all clients, because later questions depend upon answers given to earlier ones. The capitalized entries that follow the double asterisks are the user's responses.

You will be asked a series of questions about a client you are about to audit. On the basis of your answers to those questions, a set of recommendations will be presented about the appropriate materiality level(s) to be used in planning the extent of audit procedures.

1. What is the name of the client?
** EXAMPLE
2. What is Example's main line of business or industry classification?
** MANUFACTURING
3. Is this the first time that we have audited Example?
** NO
4. Have there been any acquisitions which either singly or in total amount to ten percent or more of client's total assets?
** NO
5. Some of the questions that follow will ask you to input dollar amounts from the client's financial statements. Will your answers be in terms of thousands of dollars?
** YES
6. Does Example have any publicly-traded debt or equity securities?
** YES
7. What do you project retained earnings to be?
** 7616
8. What is the amount of current assets?
** 5822
9. What is the amount of current liabilities?
** 3009
10. What do you estimate the annual income from continuing operations to be?
** 3786
11. Are the financial statements going to be used in connection with a public offering of securities?
** NO
12. Are the financial statements going to be used in connection with a transfer of interests in Example?
** NO
13. Are the financial statements going to be used in connection with a contest for control of Example?
** NO
14. Are the financial statements being used to settle some litigation involving Example?
** NO
15. Are the financial statements being used in connection with an inquiry by a regulatory commission?
** NO
16. How much long-term debt does Example have?
** 882
17. Does Example have any covenants on either its long-term debt or existing lines-of-credit?
** YES
18. Does Example have any debt covenants which restrict dividends to a percentage of either current earnings or cash flow?
** NO

19. Do any of Example's debt covenants require it to maintain some level of earnings?
** NO
20. Does Example have any debt covenants which require it to use part of its cash flow to retire its debt?
** NO

The overall materiality level to be used in planning the extent of audit procedures is 189,300.

The reasons for the materiality judgment are as follows:

The calculation of the materiality level was based on the use of income-from-continuing-operations as the base for the materiality calculation. The materiality level was calculated using a percentage rate of .05.

APPENDIX B

EXAMPLE OF AUDITPLANNER'S EXPLANATION CAPABILITIES THAT CAN BE EXERCISED DURING A CONSULTATION SESSION

The following dialogue illustrates how the normal series of questions that AUDITPLANNER asks can be interrupted to find out *why* a particular question was being asked. As before, the capitalized entries following the double asterisks represent the user's responses. The other statements are AUDITPLANNER's responses to the questions.

3. Is this the first time that we have audited Example?
** WHY
[i.e., WHY is it important to determine whether this is the first time that we have audited Example?]
[1.0] Whether this is the first time that we have audited a client is one of the five standard parameters that identify a client. This may be useful later in the consultation. For example, it is relevant in determining whether there is a need to reduce the calculated materiality level due to the increased risk associated with an initial audit of the client and is relevant in determining the percentage rate used to determine the materiality level.
[back to question 3 . . .]
** YES

(note: several questions asked by AUDITPLANNER are skipped until the next time the user asks "WHY".)

10. Is Example filing with a regulatory agency in preparation for the sale of its securities in a public market?
** WHY
[i.e., WHY is it important to determine whether Example is filing with a regulatory agency in preparation for the sale of its securities in a public market?]

[2.0] This will aid in determining the type of entity that Example is. It has already been established that
    [2.1] it is suspected that the type of entity that Example is is private.
Therefore, if
    [2.2] Example is not filing with a regulatory agency in preparation for the sale of its securities in a public market, and
    [2.3] Example does not intend to go public within the next two or three years,
Then
    it is definite (1.0) that the type of entity Example is is private. [RULE007].

(note: AUDITPLANNER explains the current rule being followed that causes it to ask question 10 about Example's plans for future financing.)

[back to question 10 . . .]
** HOW 2.1

(note: rather than answering the question, the user wants to explore further the line of reasoning being followed by AUDITPLANNER. Here AUDITPLANNER is asked about one of the conclusions that it has already made.)

[i.e., HOW was it established that it is suspected that the type of entity Example is is private?]
    [2.4] RULE056 was used to conclude that the type of entity Example is is private (.9).
    Thus, it has been established that it is suspected that the type of entity Example is is private.
[back to question 10 . . .]
** HOW 2.4
[i.e., HOW was RULE056 used?]
It has already been established that
    [4.1] Example does not have any publicly traded debt or equity securities, and
    [4.2] Example does not have restrictive debt covenants that are measured by or depend on periodic financial statement amounts or ratios that involve results of operations, and
    [4.3] Example is not controlled by a public entity.
Therefore
    there is strongly suggestive evidence (.9) that the type of entity Example is is private. [RULE056]

Appendix C

Questionnaire used to Evaluate AUDITPLANNER

Read each question and circle the response which best represents your feelings to that statement.

Where SA = Strongly Agree
A = Agree
N = Neutral
D = Disagree
SD = Strongly Disagreee

1. I found AUDITPLANNER easy to use.	SA	A	N	D	SD
2. AUDITPLANNER did not provide adequate HELP facilities to make it easy to use.	SA	A	N	D	SD
3. AUDITPLANNER asked too many questions—often about irrelevant information.	SA	A	N	D	SD
4. I think AUDITPLANNER would be useful as a training device.	SA	A	N	D	SD
5. I think AUDITPLANNER would be useful as a decision aid when planning an audit.	SA	A	N	D	SD
6. I would like to use AUDITPLANNER as a decision aid.	SA	A	N	D	SD
7. AUDITPLANNER does not exhibit a basic level of competence in making materiality judgments.	SA	A	N	D	SD
8. I would accept AUDITPLANNER's recommendations.	SA	A	N	D	SD
9. I did not enjoy using AUDITPLANNER.	SA	A	N	D	SD
10. AUDITPLANNER was too slow in making its recommendations.	SA	A	N	D	SD
11. AUDITPLANNER would be more useful as a training device than as a decision aid.	SA	A	N	D	SD
12. I can see no use for a program like AUDITPLANNER.	SA	A	N	D	SD
13. AUDITPLANNER was hard to use.	SA	A	N	D	SD
14. I would not mind my subordinates using AUDITPLANNER as a decision aid.	SA	A	N	D	SD
15. It was hard to follow AUDITPLANNER's flow of logic.	SA	A	N	D	SD
16. I made frequent use of AUDITPLANNER's question answering facilities.	SA	A	N	D	SD
17. AUDITPLANNER's question answering facilities did not adequately explain what it was doing.	SA	A	N	D	SD
18. I would not want my subordinates to use AUDITPLANNER as a training device.	SA	A	N	D	SD
19. AUDITPLANNER's line of reasoning was logical and easy to follow.	SA	A	N	D	SD
20. I enjoyed using AUDITPLANNER.	SA	A	N	D	SD
21. The sequencing of questions in AUDITPLANNER was easy to follow.	SA	A	N	D	SD

APPENDIX C—*Continued*

22. I think that AUDITPLANNER's recommendations and rationale were sound and reflected professional competence.	SA	A	N	D	SD
23. AUDITPLANNER's ability to respond to HOW and WHY questions was very helpful.	SA	A	N	D	SD
24. I would not approach the planning materiality decision the way that AUDITPLANNER did.	SA	A	N	D	SD
25. AUDITPLANNER jumped around from topic to topic	SA	A	N	D	SD

26. Please write down your overall impressions of AUDITPLANNER. Discuss what you think it could best be used for, needed improvements, potential role in an audit, etc. Use as much space as you need, including the backs of the questionnaire pages.

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An Analysis of ACRS During Inflationary Periods

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ABSTRACT: The neutrality and equity aspects of the Accelerated Cost Recovery System (ACRS), which became part of the U.S. tax law in 1981, are examined using a Monte Carlo simulation. ACRS depreciation is found to be equivalent to general price-level adjusted (GPL) depreciation only at inflation rates of between nine and 13 percent. To the extent that corporations alter their production, investment, and financing activities as a result of inflationary misstatement, the post-1980 law is nonneutral during times of inflation. Further, ACRS will result in a substantial, disproportionate relative capital shift among industries during inflationary periods, which indicates the horizontal inequity of the post-1980 law. This capital shift will be largest for capital-intensive industries having long-lived assets, such as transportation, utilities, and real estate. Both nonneutrality and horizontal inequity lead to decreased economic efficiency and a deadweight loss to the economy.

ALTHOUGH the United States is in a state of low inflation, historical evidence suggests that this condition may be only temporary. Numerous undesirable economic effects result from inflation. Effects on corporations include the misstatements of depreciation and cost of goods sold, and the omission of monetary gains and losses for income tax purposes.[1] If firms alter their production, investment, and financing decisions to mitigate these effects, the tax law is nonneutral during times of inflation, and this may result in economic inefficiency. Further, to the extent that the aforementioned inflationary misstatements are disproportionate across industries, horizontal inequity occurs.

Previous studies have indicated that the bulk of corporate inflationary tax misstatements (prior to 1981) are the result of underdepreciation (see, for example, Tideman and Tucker [1976]). Thus, a major goal of an inflation-mitigating tax system should be to attack inflationary misstatements of historically costed assets. The Accelerated Cost Recovery System (ACRS) under post-1980 law, with its shortened useful lives, may mitigate the adverse effects of underdepreciation. The purpose of this study is two-fold: first, to determine the degree to which ACRS (as determined by the Economic Recovery Tax Act of 1981 [ERTA] rules) diminishes the impact of inflation, i.e., a test of "neutrality"; and second, to determine whether such neutrality occurs evenly across industries,

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[1] Note that some relatively minor bracket creep can also occur to the extent that income could jump between any two of the widely spaced corporate brackets.

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i.e., a test of "horizontal equity," Neutrality requires that the tax law by itself not bias taxpayers' economic decisions.[2] Horizontal equity implies that taxpayers with identical economic situations are taxed equivalently.

The results of the study have tax policy implications. As discussed more fully in the next section, taxes that are either horizontally inequitable or nonneutral cause economic inefficiency and result in a deadweight loss to the economy. To the extent that post-1981 law (using ACRS) has either of these two attributes, a welfare loss will result. This loss may diminish or offset any economic growth resulting from the general capital formation incentives provided by ACRS.

BACKGROUND

If not compensated for, inflation affects corporate taxation in three important ways. First, it results in underdepreciation of fixed assets; corporations must depreciate their fixed assets based on historical cost when this cost often understates the replacement values of their assets. Such underdepreciation decreases corporations' depreciation deductions, thus increasing both taxable income and taxes. Even during periods of low inflation, this understatement is large since it reflects years of cumulative price increases. Second, inflation results in an understatement of inventory values because firms state their inventories (cost of goods sold) on a historical basis, causing understatement of the inventory's replacement value. This understatement means a lowered deduction for cost of goods sold and an increase in the corporation's taxable income, thus raising its income tax [Laffer and Ranson, 1979].[3]

A third effect results from the omission of monetary gains and losses because historical valuation of liabilities does not account for the erosion of the principal portion of liabilities due to inflation. In anticipation of this erosion, lenders are thought to increase their interest rates, thus converting what would be increased principal into interest [Laffer and Ranson, 1979]. When the anticipated inflation rate (at the time of liability incurrence) equals the actual future inflation rate, principal erosion exactly equals increased interest and a net wash results to both firms. However, if the anticipated and actual inflation rates are unequal, a net monetary gain or loss may result. Regardless of whether anticipated and actual inflation are equal, however, increased interest rates during inflationary periods result in debtor corporations receiving partially undeserved interest deductions which are taxed to creditor corporations.

Several serious economic consequences may be attributable to the aforementioned three distortionary effects of inflation on corporation taxation [Frigo, 1981; Tideman and Tucker, 1976]: (1) erosion of real financial capital; (2) changed factor input mixes; (3) altered capital structures; (4) distorted capital project selection; and (5) increased incentives for merger. Erosion of real financial capital occurs because firms are taxed on reported profits that are higher than economic profits during inflationary periods. This effectively results in a partial tax on financial capital and, over time, reduces real financial capital. Changes of factor inputs into production may occur because inflation encourages firms to switch from capital to labor due to underdepreciation on fixed assets and the current deductibility of labor costs. Similarly, altered capital structures might occur because inflation causes firms to borrow more because debt is cheaper than equity and interest is fully deductible. Distortions in capital project selection could result because inflation causes the required rates of return for investments to increase, especially longer-lived investments. Finally, increased incentives for merging might occur because of tax benefits resulting from merging with loss corporations and/or merging before liquidation.

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[2] This is the same view of neutrality expressed by many researchers. Neutrality should not be confused with the aspect of a tax law specifically aimed at altering taxpayers' fiscal behaviors (e.g., investment credit to encourage investment in capital). Neutrality (as defined in this study) deals with unintentional fiscal impacts and can (ideally) coexist with a designed fiscal policy tax provision.

[3] Laffer and Ranson [1979] found that fictitious profits accounted for more than half of corporate tax liabilities in 1974, and in 1978 taxes on fictitious profits were two-thirds as large as taxes on economic profits.

These distortions by firms indicate that the corporate tax law may be increasingly nonneutral during inflationary periods. The largest source of this nonneutrality during inflationary periods is underdepreciation.[4] Thus, a key objective of a tax system seeking inflation neutrality would be to eliminate underdepreciation. Underdepreciation also results in horizontal inequity in that some firms are proportionately more seriously affected than others solely because of their capital structure.

Both nonneutrality and horizontal inequity may lead to negative economic consequences. In welfare economics, capital is efficiently allocated when gross (pre-tax) returns are equated at the margin (after adjusting for risk). Gross returns are defined as the marginal revenue product of capital. Without a tax, resources are assumed to be allocated efficiently and productivity is maximized. However, when a nonneutral tax is imposed on capital, capital markets will adjust to reach an after-tax maximizing equilibrium. Since this movement results in an allocation of capital away from the previous (efficient) equilibrium, economic inefficiency results and the resultant decline in productivity is a deadweight loss. Thus, as firms change their capital investments to mitigate under- (or over-) depreciation due to inflation, a welfare loss results. As a result of uneven efficiency losses by industry, horizontal inequity obtains. In the classic Harberger [1962] model, capital will flow out of sectors (industries) less tax-favored and into tax-favored sectors. The result again is economic inefficiency and a deadweight loss, since capital is shifted out of its pre-tax equilibrium, which presumably was previously efficiently allocated.[5]

Studies on Inflationary Effects on Pre-1981 Corporate Taxation

Pre-1981 U.S. law addressed undercosting of inventories during inflationary periods by allowing LIFO. It did not provide for underdepreciation and monetary gains and losses. Even inventory undervaluation was not adequately dealt with, since less than 50 percent of U.S. corporations used LIFO [*Accounting Trends and Techniques*, 1981].

The extent of inflationary tax misstatement under pre-1981 U.S. tax laws has been studied by Tideman and Tucker [1976], Davidson and Weil [1976, 1978], Laffer and Ranson [1979], and Dworin [1977]. While these researchers report that pre-1981 law severely misstated taxes during times of inflation, they do not agree as to either the total magnitude of this misstatement or the specific amount of industry misstatements.

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[4] Previous studies have shown that, except for a sudden jump in inflation (when monetary gains dominate the depreciation effect for that year only), underdepreciation dominates both monetary gains/loss and undercosting of cost-of-goods-sold effects. See, for example, Tideman and Tucker [1976].

[5] For a general discussion of welfare loss and economic inefficiency in light of the Harberger model, see McClure and Thirsk [1975].

Table 1
Industry Rankings*
Inflationary Tax Misstatement
Pre–1981 Law

Tideman and Tucker	*Frigo***	*Davidson and Weil*
Railroads (233)	Electrical, Electrical Machinery	Steel (689)
Airlines (92)	Fabricated Metals	Utilities (122)
Financials and Real Estate (65)	Machinery	Miscellaneous Dow Jones Industrials (22)
Communications (48)	Chemicals	Pharmaceuticals (20)
Utilities (48)	Measurement Instruments	
Petroleum Refining (39)	Transportation	
Primary Metals (36)	Textiles	
Trade (29)	Food	
Durable Goods Manufacturing (25)	Primary Metals	
Other Nondurable Goods (23)	Utilities	
Chemicals, Rubber Manufacturing (22)		
Food and Related Products (21)		
Fabricated Metals (20)		
Construction (18)		
Transportation Equipment (17)		
Services (13)		
Electrical Equipment (8)		
Mining (7)		

* Percent inflationary misstatement in parentheses.

** The Frigo study indicated relative rankings of inflationary misstatement by industry but did not calculate percent inflationary tax misstatements.

Table 1 summarizes the inter-industry results reported by three of these studies.

The discrepancies in the results reported in these studies might be attributable to differences in both data sources and methods. Tideman and Tucker [1976], for example, examined steady-state inflation, while other studies assumed differential inflation rates.

The Law under ERTA

One of the key provisions of the Economic Recovery Tax Act of 1981 (ERTA) was ACRS. The inflation-mitigation abilities of an ACRS-type system were investigated in a sensitivity analysis by Feldstein [1981]. Using hypothetical asset costs, useful lives, rates of return, and inflation rates, Feldstein compared rates of return of price-level-adjusted assets versus a system allowing for five-year depreciation of personal property and ten-year depreciation of realty. He found that at moderate rates of inflation and costs of capital, the two systems were equivalent. However, low inflation rates, high firm discount rates, or short-lived assets caused accelerated depreciation to exceed price-level adjusted depreciation.

The ability of ACRS to deal with inflation has been investigated by Hasbrouck [1983], who conducted a macroeconomic simulation to determine the inflation rate at which there would be no net inflationary tax burden. Hasbrouck found that such inflation neutrality occurred at inflation rates of approximately 13 percent under ERTA.

Research Design and Method

While the Hasbrouck [1983] and Feldstein [1981] studies provided evidence that ACRS may mitigate inflationary impacts on corporate taxation, Feldstein may have used oversimplifying assumptions and Hasbrouck used data bases that may have resulted in measurement error.[6] Thus, the research question addressed in these two studies is investigated using this study's differing research method and data base:

H_1: On an overall (macroeconomic) basis, ACRS and general price-level[7] (GPL)-determined depreciation are equal.

Neither the Hasbrouck [1983] nor Feldstein [1981] study investigated industry impacts of inflation. Thus, the neutrality and horizontal equity of ACRS (with implications for economic inefficiency) were not addressed. This industry effect is investigated in this study, or:

H_2: The ratio of ACRS to GPL-determined depreciation is equal across industries.

The first hypothesis seeks to determine the neutrality of ACRS during inflation on a macroeconomic basis. Since the basic model for depreciation in the simulation is

$$\text{Depreciation} = f(\text{tax system used, industry membership}), \quad (1)$$

an appropriate statistical test design is blocked ANOVA, with the tax system (ACRS or GPL) used as the manipulated variable and industry the blocked variable. Note that the inflation rate, while manipulated, is constant across these two variables. The industry membership variable conveniently controls for a multitude of industry-specific factors that would cause varying inflationary effects on depreciation, such as capital intensity, useful lives, discount rates, and effective tax rates. Since the ANOVA results only provide overall test statistics, parametric tests of ANOVA means will be the primary statistical test for the first hypothesis. Using the ANOVA means gives more detailed information on the equality of depreciation using ACRS and GPL.

To test for industry effects, depreciation is determined by four methods: undiscounted, discounted, scaled and discounted, and the tax effect of scaled and discounted. Discounted depreciation allows for the additional effects of industry-specific reinvestment rates, and thus may give a more accurate assessment of the value of the depreciation to that particular industry (see Feldstein [1981]), and in total may provide a more accurate measurement of the social cost of inflationary misstatement of depreciation. Using scaled depreciation (total depreciation divided by total fixed assets) provides an alternative view of depreciation by "standardizing" and giving more weight to less fixed-asset intensive industries. Tax-affected (i.e., using specific industry-average effective tax rates) depreciation may provide additional measurement accuracy. In all four measurements, nominal depreciation for each year in the 20-year simulation is deflated into 1980 dollars (the base year of the simulation).

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[6] Hasbrouck surrogated price-level change effects with Federal Reserve replacement cost figures (i.e., the Federal Reserve Board's data may not have accurately surrogated taxable income and may have resulted in some measurement error).

[7] General Price Level accounting is determined by the method provided for in Financial Accounting Standards Board (FASB) Opinion No. 33 (which was later suspended by FASB Opinion No. 82). Casler and Hall [1985] show that when a firm has at least ten asset classes, a composite price index (in their study, the Wholesale Price Index) is a reasonably accurate surrogate for numerous specific price indices. It is reasonable to expect that when industry data are used (having numerous asset categories), this surrogation is even closer. Replacement cost was not used in this study as a measure of inflation neutrality because of lack of data; previous studies using replacement cost data have either been resigned to macroeconomic conclusions [Hasbrouck, 1983] or have used limited samples [Feldstein and Summers, 1979].

The second hypothesis tests for the horizontal equity of ACRS during times of inflation. As previously mentioned, horizontal inequity may result in investors shifting their portfolios to tax-favored industries. An alternative measure of the horizontal equity of the law under ERTA is to compare total tax under ERTA to tax with full GPL adjustments, that is, with inventory price-level adjustments and monetary gain (loss) calculations. This comparison allows for a calculation of the total cash flow effects of the nonneutrality of post-1981 law and provides a more realistic picture of potential investor reactions. This comparison is also made as a part of H_2.

Research Design

The research design is a Monte Carlo simulation. The simulation will be over a projected 20-year period. After 20 years, the impact of sudden inflation (in the simulation's first year) should have reached "steady state."[8] Further, at most discount rates, the present value of a dollar is fairly close to zero after 20 years. The use of a simulation approach to study this phenomenon was selected for several reasons. The most important reason is internal validity; the objective of this study is to examine the complex relationships of inflation and taxes with minimum confounding (e.g., the uncontrolled influence of macroeconomic conditions, which could occur if actual data were examined over time). A second advantage of a simulation is that it provides for modeling of complex relationships that are not amendable to analytic modeling. Since inflation is nonlinear in its effects over time (see Hasbrouck [1983]), this modeling tractability of a simulation is clearly an advantage. Third, a simulation allows for the use of empirical data as starting conditions, adding certain external validity. In this study, actual industry data are used, allowing for meaningful tax policy implications. Fourth, a simulation allows for examination of alternative scenarios while holding all other factors constant. Thus, for example, rates of inflation can be varied (a sensitivity analysis) while holding industry growth rates, etc., constant so that the results are solely a function of changing inflation rates.

The Data

The data are from the U.S. Treasury's 1980 Corporate Statistics of Income [U.S. Treasury, 1982]. They represent statistical composites of their respective industries, and they include all taxpaying industries.[9] The data include (taxable) income statements, balance sheets, gross taxes, and credits by industry. The Treasury statistics were estimated by stratified random samples of corporate returns on file with the Internal Revenue Service. A more detailed explanation of the sampling procedure is in Publication 647 [U.S. Treasury, 1978]. The data are from 1980 statistics and thus are unaffected by firms' behavioral reactions to the 1981 passage of ERTA.

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[8] Monetary gains/losses and undervaluation of inventory achieve steady state within one year. Underdepreciation will have achieved steady state for old assets (by definition) and for newly acquired assets (given an average composite industry life of 32 years and that steady-state under-depreciation occurs halfway through an asset's life). Note that the "steady-state" inflation rate is already achieved at the start of the experiment due to prespecified truncation of the inflationary distributions.

[9] The agriculture, forestry, and fishing industry was excluded from the analysis since industry statistics vary so widely (e.g., inventory turnovers for catfish farms versus forest-growing firms) that reliable industry-average statistics were not obtainable. Since this industry only accounts for one percent of total corporate tax revenues, its omission should not affect any of this study's conclusions. The motor vehicle transportation manufacturing industry has such cumulative large tax loss carryforwards, and such a small projected growth, that it is unlikely to pay any taxes in the next 20 years. Since, by paying no taxes, this industry would not (in the sense defined in this study) vary from inflation neutrality, it was excluded so as not to bias the results.

While many of the data needed on these industries are contained in the Treasury publication, some data are missing. Accordingly, some assumptions must be made. These assumptions include: (1) FIFO, LIFO, and moving-average industry averages for inventories [Accounting Trends and Techniques, 1981] will continue in the future; (2) the Industry's growth rate will follow the five-year trend calculated by U.S. Industrial Outlook [Bureau of Industrial Economics, 1983]; (3) inventory turnover is the 1980 ratio of cost of goods sold to average inventory; (4) the tax-accounting lives of industries' fixed assets are calculated from 1980 balance sheets by dividing 1980 fixed assets by total 1980 depreciation expense (including that in cost of sales) and by assuming pre-1981 equipment and structures are depreciated on average by the 150-percent declining-balance methods. This last assumption is based upon pre-ERTA rules in Code Sec. 167 (personal property was eligible for double declining balance [DDB], 1.5 declining balance [DB] if used, and straight-line [SL] if a useful life of three years; real property was generally eligible for 1.5 DB if new, SL if used). Real versus personal property ratios were obtained from Survey of Manufacturers' Data [U.S. Department of Commerce, 1981] for manufacturers and from Survey of Current Business for nonmanufacturers [U.S. Department of Commerce, 1980]. Real growth rates of income statement and balance sheet accounts will change proportionately based on the aforementioned growth projections. Real fixed asset replacement is assumed to be based on capital recovery assuming straight-line depreciation.[10]

Individual industry costs of capital and average effective tax rates will be used in the simulation. The individual tax rates are necessary due to pronounced industry differences, e.g., services (with many small companies) pay 23 percent tax rates on average, while mines and petroleum (with add-on preference taxes) pay 52 percent rates on average. Effective tax rates are calculated as gross federal income taxes, less investment credit, plus preference taxes, divided by domestic taxable income.[11] Weighted after-tax costs of debt and equity capital are calculated directly from 1980 industry data.[12]

For the simulation, it was assumed that inflation would follow a pattern as forecasted by Box-Jenkins time-series analysis.[13] The time-series model was built using actual 1930–80 GNP implicit price deflator inflation rates. GNP

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[10] Thus, for example, if industry A's straight-line depreciation for the year were $100,000, then $100,000 (in current dollars) of additional fixed assets would be acquired as replacement to maintain a fixed stock of productive capital. This replacement was also multiplied by the industry's projected growth rate (if any). The straight-line recovery assumed that calculated useful lives are accurate. Useful lives are derived directly from Statistics of Income balance sheets. These balance sheets generally conform to generally accepted accounting principles (GAAP) balance sheets and hence GAAP useful lives.

[11] There is a considerable and unresolved controversy over effective tax rates (ETR). The measure used in this study is intended as only one reasonable method of determining ETR.

[12] Costs of debt were calculated by dividing after-tax interest expense (interest expense times one minus the calculated effective tax rate) by total debt. Cost of equity was after-tax taxable income divided by owner's equity. Weighted costs of capital were obtained by adding (1) after-tax return on debt times the ratio of debt to debt plus equity, plus (2) after-tax return on equity times the ratio of equity to debt plus equity.

[13] A structural (econometric) forecast of inflation was an alternative consideration, but was rejected for two reasons. First, univariate Box-Jenkins models have been found to equal, if not outperform, econometric forecasts of GNP implicit price deflator [Nelson, 1973]. Second, econometric models are subject to potential omitted-variable bias and measurement error because of the multiple experimental variables involved [Johnston, 1972]. This shortcoming is minimal in univariate Box-Jenkins.

TABLE 2
ANOVA *F*-TEST STATISTICS
ACRS VS. GPL

	Tax System	*Industry*
Undiscounted Depreciation	5.94*	47.15*
Discounted Depreciation	1.54	29.61*
Scaled, Discounted Depreciation	46.88*	29.61*
Tax Effect of Scaled, Discounted Depreciation	36.15*	53.47*

* Significant at the .05 level
Note: Sums of squares not shown due to magnitude of figures (hundreds of trillions).

implicit price deflator was forecast using the following model:

$$(1-B^1)(1-\phi_1 B^1)(1-\phi_2 B^2)Z_t=a_t \quad (3)$$

where ϕ_i are the autoregressive parameters, B is a backshift operator, Z_t is GNP implicit price deflator for year t, and a_t is white noise. Model parameters with standard errors in parentheses are $\phi_1=1.041(.0418)$ and $\phi_2=-.5408$ (.0269). Diagnostic checks indicated white noise residuals and model stationarity. Thus the model is an AR(2), indicating that price levels are a function of the previous year's price levels and, to a lesser extent, of price levels two years prior. To validate the model, forecasts were compared to actual 1981–83 rates and were correct within two standard errors (see Appendix 2). In the Monte Carlo simulation, each year's inflation forecast had added to (subtracted from) it a randomly determined, normally distributed shock term (within two standard errors).

In the simulation, (taxable) income statements (including depreciation, which is separately calculated), balance sheets, and taxes will be calculated over 20 years with 400 replications per year for each industry.[14] The means of the sum of these vectors of depreciation (using each of three measures) and total tax (deflated and discounted) for ERTA rules and full GPL rules will be the output variables to be used in statistical analyses. Each 20-year replication is different because of the Monte Carlo nature of the inflation error term and its nonlinear impact on depreciation and total tax.

RESULTS

Table 2 reports the calculated *F*-statistics for the Monte Carlo simulation. Separate blocked ANOVA tests are reported for each of the four measures of depreciation. Critical $F_{.05}$ values are 3.07 for tax system and 1.50 for industry. Interaction terms were tested and were not significant. The data were subjected to a Box-Cox power transformation (where θ was set to .5, roughly a

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[14] The sample size selected (400) was based on a two-step multiple comparison procedure by Dudewicz, Ramberg, and Chen reported in Kleijnen [1975]. The method assumed that the variances of variables to be compared (in this case, deflated, discounted, and tax-affected depreciation) are unknown and possibly unequal. The sample size is designed to result in detecting a five percent or less difference in true (population) means. The heteroscedasticity assumption results in sample sizes larger than necessary to satisfy pairwise tests with more restrictive distribution assumptions (e.g., Bonferroni tests). Each 20-year sample had identical starting values and seed, thus the results were not autocorrelated.

TABLE 3
OVERALL TREATMENT MEANS
ACRS vs. GPL DEPRECIATION

	ACRS	*GPL*
Undiscounted Depreciation	7379.40	6817.70
Discounted Depreciation*	16715.00	15276.00
Scaled, Discounted Depreciation	5.98	5.16
Tax Effect of Scaled, Discounted Depreciation	2.33	1.98

* Means do not differ at .05 using Dunn's multiple comparison procedure. Means derived from data (in trillions of 1980 dollars) subjected to Box-Cox power transformation.

square-root transformation) to correct for heteroscedasticity.

The tests indicate that both tax system and industry clearly affect depreciation. By all four measures of depreciation, industry effects are strong, and except for discounted depreciation, differences in tax system also account for a significant difference in depreciation. Corroborative results were found using a nonparametric test, Friedman's two-way analysis of variance by ranks test.[15] The significance of the tax system variable indicates potential nonneutrality of ACRS, and the significance of the industry variable implies uneven industry effect or horizontal inequity.

Table 3 shows the results of parametric tests of means for each of the four measures of depreciation. Means are industry-wide for ACRS and GPL-computed depreciation. The primary test is Dunn's multiple-comparison procedure ("Bonferroni" test), but tests using Scheffe's method, Tukey's HSD, and Duncan's multiple-comparison procedure were also used. The tests control varying degrees of Type I and II error rates. Adjacent means having asterisks in Table 3 are not statistically different at the .05 level using all of these tests. The findings corroborate the ANOVA results; except for discounted depreciation, ACRS and GPL depreciation are not equal. For every measure of depreciation, the mean of ACRS depreciation is larger than the mean of GPL-computed depreciation.

Thus, from an economy-wide perspective, it appears that ACRS will result in nonneutrality during inflationary periods. To test whether ACRS can ever be neutral, a sensitivity analysis is performed, using different constant rates of inflation. Table 4 shows pairwise tests of means for depreciation using the two taxing systems at four rates of inflation and also for discounted versus undiscounted depreciation. The inflationary rates are low (four percent) to high (20 percent), with one of the intermediate rates (13 percent) set at the rate found by Hasbrouck [1983] to be where ACRS is roughly inflation-neutral.

The results indicate some sensitivity to cost of capital. Assuming discounted depreciation, ACRS depreciation exceeds GPL depreciation until 13 percent inflation, at which point the two are

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[15] Note that F- and t-tests are fairly robust with even moderate departures from normality [Shannon, 1975]. The largest Hartley F_{max} ratio of variances was 1.04, adding further support for the notion of homoscedasticity and the use of parametric pairwise mean tests.

TABLE 4
SENSITIVITY ANALYSIS
OVERALL TREATMENT MEANS
ACRS VS. GPL DEPRECIATION

Inflation Rate	*Depreciation Measure*	*ACRS*	*GPL*
4%	Total Depreciation*	5707.90	5098.90
	Scaled Depreciation	.72	.65
	Tax Effect of Scaled Depreciation	.29	.26
	Discounted Total Depreciation	13259.00	12021.00
	Scaled, Discounted Depreciation	5.03	4.53
	Tax Effect of Scaled, Discounted Depreciation	2.01	1.81
9%	Total Depreciation*	5596.00	5848.00
	Scaled Depreciation*	.57	.58
	Tax Effect of Scaled Depreciation*	.22	.22
	Discounted Total Depreciation	11571.00	10624.00
	Scaled, Discounted Depreciation	3.31	3.02
	Tax Effect of Scaled, Discounted Depreciation	1.29	1.16
13%	Total Depreciation	6674.20	7721.10
	Scaled Depreciation	.49	.58
	Tax Effect of Scaled Depreciation	.19	.22
	Discounted Total Depreciation*	11158.00	11114.00
	Scaled, Discounted Depreciation*	2.49	2.34
	Tax Effect of Scaled, Discounted Depreciation*	.96	.92
20%	Total Depreciation	8714.00	10234.00
	Scaled Depreciation	.37	.55
	Tax Effect of Scaled Depreciation	.15	.21
	Discounted Total Depreciation	11521.00	12774.00
	Scaled, Discounted Depreciation	1.62	1.76
	Tax Effect of Scaled, Discounted Depreciation*	.64	.68

* Means do not differ at .05 using Dunn's multiple comparison procedure. Identical results were obtained using Scheffe's, Tukey's HSD, and Duncan's multiple-comparison procedures. Means derived from data (in trillions of 1980 dollars) subjected to Box-Cox power transformation.

statistically equal. Beyond this 13 percent rate, GPL depreciation is larger than ACRS. Using undiscounted depreciation, the two systems are statistically equivalent only at the lower nine percent inflation rate. Below the nine percent rate, ACRS exceeds GPL, and beyond this rate the relationship is reversed. The difference in conclusions due to discounting is based on industry magnitude and costs of capital. Thus, for example, if industry A shows larger GPL than ACRS depreciation at, say, nine percent inflation (before discounting), while larger (or more fixed-capital-intensive) industry B shows the opposite relationship, then the mean of the two would likely show ACRS exceeding GPL depreciation. Assuming the same two industries, except now discounting assuming a much higher reinvestment rate for industry A than for industry B, then the means of the two tax systems for the two industries will likely show that GPL exceeds ACRS.

The results of Table 4 are consistent with prior studies. Feldstein [1981] postulates that the two types of systems would be equivalent at moderate rates of inflation and discount. Since all industry discount rates were used in this study, it would not be unreasonable to assume that on average, moderate discount rates were used. Hasbrouck's [1983] conclusion of the inflation effectiveness of ACRS-based tax at approximately 13 percent inflation appears to be corroborated here for discounted depreciation.

To ascertain that the simulation's results were not invalid, certain validation procedures [Van Horn, 1971] were performed. Two such procedures, validation of the Box-Jenkins inflation forecast and sensitivity analyses, were previously mentioned. Industry sales forecasts (to 1983) were generally correct within two standard errors. Due to the uncertain nature of inflation (especially over the next 20 years), an alternate inflation scenario was used to convergently validate the Box-Jenkins simulation. Using actual 1930–80 GNP implicit price deflator changes, a randomly selected distribution (with replacement) was used, truncating the possible random selections at historical high and low rates. The distribution, in cumulative deciles, appears in Appendix 2. Parametric pairwise tests of means between ACRS and GPL depreciation using randomly ordered inflation rates appear in Appendix 3, and the results corroborate the original simulation's results.

Industry Comparisons

Table 5 shows ACRS depreciation as a percent of GPL depreciation by industry using three measures of depreciation. The results were derived from the original Monte Carlo simulation. As can be seen, the ACRS:GPL ratio is not close to unity for most industries (i.e., further evidence of nonneutrality) and this ratio in fact varies widely by industry (i.e., horizontal inequity).

If a greater than ten percent variation from unity is chosen as significant, then 27 of the 38 industries show ACRS significantly in excess of GPL depreciation. These results hold consistently for all three measures of depreciation shown in Table 5. Six of the aforementioned 27 industries show ratios near or in excess of 1.5, showing a tremendous benefit from ACRS *vis-a-vis* other industries. Four of these industries—rubber and plastics, chemicals, stone products, and transportation—are characterized by old assets needing infrequent replacement, largely due to heavy emphasis on batch productions (for the first three, which are manufacturers) and due to slowly changing technology. The real estate industry is characterized by mostly fixed asset investments in real estate, which are generally subject to 18-year writeoffs, a significantly shorter writeoff than under pre-1981 laws.[16] The communications industry is characterized by long-lived assets and heavy investment in buildings (and other structures).

Thus, Table 5 indicates the potential nonneutrality and actual horizontal inequity of ACRS during inflationary periods. Generally, industries having the longest-lived assets benefited most from ACRS, but were also undertaxed *vis-a-vis* inflation-neutral tax. Interestingly, there are only small differences in the ACRS:GPL ratios for each of the three measures of depreciation. However, when these differences are translated into total depreciation tax dollars, industry magnitudes cause these small percentage changes to result in large differences in economy-wide depreciation means. As an indication of this magnitude, Table 6 shows the projected 20-year variance from inflation neutrality by industry in dollars and in percentages. For comparative purposes, pre-1981 tax is also shown.

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[16] The writeoff period is 19 years if the property was acquired after May 19, 1985.

TABLE 5
INDUSTRY STATISTICS
ACRS DEPRECIATION AS A PERCENT OF GPL DEPRECIATION (1.0 = 100%)
ASSUMING BOX-JENKINS FORECASTED INFLATION

Industry	*Total Depreciation*	*Scaled Depreciation*	*Tax Effect of Scaled Depreciation*
Metal Mining	0.97202	0.99063	0.99075
Coal Mining	1.15733	1.16294	1.16246
Oil, Gas Extr.	1.16074	1.15661	1.15683
Nonmet. Min.	0.97898	0.97039	0.97025
Construction	1.02344	1.03223	1.03208
Food Prdcts.	1.24730	1.24410	1.24415
Tobacco	1.09207	1.10705	1.10707
Textiles	1.14143	1.14403	1.14429
Apparel	1.21941	1.21415	1.21439
Lumber, Wood	1.06925	1.07410	1.07415
Furn., Fixt.	1.37637	1.35942	1.35925
Paper Prod.	1.16232	1.16773	1.16761
Printing, Pub.	1.12477	1.13447	1.13442
Chemicals	1.52095	1.47879	1.47918
Petrol. Prod.	1.24029	1.23089	1.23063
Rubber, Plast.	2.39773	2.25588	2.25782
Leather Prod.	1.38791	1.35740	1.35716
Stone, etc.	1.67385	1.61890	1.61817
Primary Mtls.	1.26738	1.25115	1.25078
Fabr. Mtls.	1.08753	1.09867	1.09865
Machinery	1.09291	1.09944	1.09942
Elect. Equip.	1.11526	1.20966	1.20959
Trans. Equip.	1.21537	1.23274	1.23272
Instruments	1.10040	1.12659	1.12644
Misc. Manuf.	1.38280	1.35808	1.35834
Transportation	1.49657	1.47405	1.47407
Communication	2.18352	2.06368	2.06361
Utilities	1.29744	1.31872	1.32372
Wholesalers	0.98041	1.02637	1.02659
Retailers	1.02048	1.04963	1.04969
Banking	1.27326	1.27313	1.27290
Cr. Agencies	1.09772	1.11979	1.07657
Sec,Cmd Brkrs	0.86949	0.92255	0.92294
Insurance	1.13135	1.15250	1.15240
Ins. Agents	0.89733	0.94836	0.94760
Real Estate	1.92938	1.85211	1.85259
Holding Co's	1.24408	1.26127	1.26444
Services	1.17151	1.17218	1.17159

Underlying inflationary, discount rate, and effective tax rate assumptions are those of the original simulation. Total tax is measured allowing for inclusion of inflationary inventory misstatements and omitted monetary gains or losses. Thus, the total cash flow magnitude of inflationary misstatement is measured. Beginning fixed assets are indexed up to 1980 price levels for GPL purposes to show not just the variance of ACRS from GPL for post-1980 assets, but to also show accumulated underdepreciation on existing fixed assets.

The first two columns of Table 6 indicate total tax overpayments by industry.

TABLE 6

TWENTY-YEAR VARIANCE OF EACH SYSTEM FROM INFLATION NEUTRALITY
ASSUMING BOX-JENKINS FORECAST INFLATION
TOTAL TAX—DISCOUNTED (IN THOUSANDS OF 1980 DOLLARS)

	Total		*As a Percent of Tax* (1.0=100%)		
Industry	*Old U.S.*	*New U.S.*	*Old U.S.*	*New U.S.*	*Col. 4–Col. 5*
Metal Mining	20275.44	19144.75	0.6668	0.1277	.5391*
Coal Mining	37846.00	25342.91	0.6067	0.4063	.2004*
Oil, Gas Extr.	38749.24	22701.36	0.0951	0.0557	.0394*
Nonmet. Min.	20285.59	19564.74	1.4902	1.4373	.0529
Construction	131416.02	117688.03	0.7314	0.6550	.0764*
Food Prdcts.	160366.53	103987.60	0.2325	0.1508	.0817*
Tobacco	16475.68	12466.86	0.1731	0.1310	.0421
Textiles	50001.84	40328.87	0.4279	0.3451	.0828*
Apparel	12260.03	8324.11	0.1080	0.0733	.0347
Lumber, Wood	69365.33	57943.42	3.8624	3.2264	.6360
Furn., Fixt.	11764.55	5482.07	0.2056	0.0958	.1098*
Paper Prod.	85665.22	63491.03	0.4963	0.3679	.1284*
Printing, Pub.	35346.83	22402.85	0.1430	0.0906	.0524*
Chemicals	127930.61	28393.69	0.1468	0.0326	.1142*
Petrol. Prod.	385179.17	269210.57	0.1921	0.1343	.0578*
Rubber, Plast.	25924.88	6379.08	0.1922	0.0473	.1449*
Leather Prod.	2398.42	1824.91	0.0963	0.0732	.0231
Stone, etc.	82856.32	63260.98	1.7072	1.3035	.4037
Primary Mtls.	111842.22	78196.76	0.4458	0.3117	.1341*
Fabr. Mtls.	90298.76	68693.02	0.2826	0.2150	.0676*
Machinery	162364.24	125453.25	0.2165	0.1673	.0492
Elect. Equip.	164590.55	22324.80	0.0921	0.0125	.0796*
Trans. Equip.	114497.46	66456.20	0.3352	0.1653	.1699*
Instruments	43428.35	27992.50	0.2382	0.1535	.0847*
Misc. Manuf.	14576.10	5665.90	0.1468	0.0567	.0990*
Transportation	229704.38	−29955.00	0.7377	−0.0962	.8339*
Communication	56262.28	−223383.50	0.0169	−0.0669	.0838*
Utilities	183387.01	191433.20	3.0040	1.1897	1.8143*
Wholesalers	135201.62	98522.50	0.0942	0.0687	.0255
Retailers	142791.69	68929.60	0.0170	0.0082	.0088
Banking	−287676.28	−314745.00	−0.3984	−0.4359	.0375
Cr. Agencies	−37606.74	−29619.80	−0.2014	−0.1586	.0428
Sec,Cmd Brkrs	1288.03	1250.30	0.0064	0.0063	.0001
Insurance	104472.41	96737.30	0.3026	0.2802	.0224
Ins. Agents	5784.24	5417.70	0.1255	0.1176	.0079
Real Estate	34484.48	−148320.80	0.1472	−0.6330	.7802*
Holding Co's	46615.59	44561.70	0.6550	0.6261	.0289
Services	10365.63	3891.00	0.2705	0.1015	.1690*

* Significant at the .05 level.

Because beginning fixed assets are indexed (and thus cumulative underdepreciation is calculated), underdepreciation is highlighted and the results generally show that industries overpay taxes, whereas results in preceding tables (using a marginal analysis of post-1980 asset acquisitions) indicated that industries (using ACRS) underpay taxes. Clearly, differences in magnitude by industry are large, driven partly by industry characteristics during inflation and partly by sheer differences in industry size. In two industries, banking and credit agencies, taxes are actually underpaid due to untaxed monetary gains. When size is controlled for (tax misstatement is expressed as a percent of total tax), columns 3, 4, and 5 highlight industry differences in general inflation neutrality. As in Table 5, it is again apparent that current (and pre-1981) tax laws are far from inflation-neutral and are horizontally inequitable.

The fourth column of Table 6 indicates inflationary tax misstatements assuming post-1980 law. While such misstatements are reduced *vis-a-vis* pre-1981 law for many industries because of ACRS, not all industries are closer to inflation neutrality and furthermore, inflationary misstatement is quite varied across industries. As indicated in column 5, ACRS results in statistically significant reductions in inflationary taxes for 23 of the 38 industries.[17] In some of these industries, most notably real estate, ACRS overcompensates for inflation and results in underpayment of tax *vis-a-vis* inflation neutrality. The industries with the largest statistical change are capital-intensive with long-lived assets (transportation, communication, utilities, and real estate).[18] Of the 15 industries whose inflationary tax payments were not statistically affected by ACRS, 11 (tobacco, apparel, leather, merchandising, all financial institutions, and holding companies) were not significantly affected by underdepreciation before ACRS. The remaining four industries are characterized by low debt-to-equity ratios or slow inventory turnovers, attributes which result in overtaxation during times of inflation and which are not mitigated by ACRS.

As a final indication of this horizontal inequity created by ACRS, the projected 20-year shift in tax incidence because of ACRS is shown in Table 7. Assumptions are the same as those of the initial simulation. Some industries will receive huge benefits from ACRS simply due to their sizes (e.g., electrical equipment manufacturers), as indicated by the third column in the table. A more revealing statistic is the percentage change in tax, as shown in the last column. Twenty-seven industries show a statistically significant decrease in tax due to ACRS.[19] Transportation, utilities, and real estate show the statistically largest benefits from ACRS. The 11 industries not significantly benefiting from ACRS are generally characterized by relatively short-lived assets and/or proportionately low depreciable capital-intensity.

SUMMARY AND POLICY IMPLICATIONS

The results of the Monte Carlo simulation indicate that, on a macro basis, ACRS may be inflation-neutral only at inflation rates of between nine and 13 percent. At inflation rates below nine percent, ACRS depreciation is in excess of inflation-adjusted depreciation, and at rates of inflation above 13 percent the opposite is true, on a macro basis. Since projected inflation rates are less than nine percent (subject to occasional fluctuations), ACRS depreciation will exceed inflation-adjusted depreciation and thus will not be neutral in the future.[20] To the

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[17] The statistical test used is a Z-test for differences between two population proportions. Since the sample size for the two population proportions (columns 3 and 4 in Table 6) is large (400), we may assume asymptotic normality for the test. Where either columns 3 or 4 exceed unity, they are scaled to obtain proportions below unity for purposes of the statistical tests.

[18] Calculated Z-statistics for these industries are 25.3, 27.9, and 26.0, respectively.

[19] The statistical test used is a t-test of the equality of the means of two normally distributed populations with unknown population variances. Sample variances for the two population means (columns 1 and 2 in Table 7) were from mean variances (over 400 replications) reported in the output of the Monte Carlo simulations.

[20] Inflation rates over the last 50 years follow a slightly left-skewed distribution, with a mean of about 6.5 percent. Inflation rates have rarely been double-digit for GNP implicit-price deflator.

TABLE 7

TWENTY-YEAR SHIFT IN TAX INCIDENCE FROM CHANGE IN LAW
TOTAL TAX—DISCOUNTED (IN THOUSANDS OF 1980 DOLLARS)

			Difference	
Industry	*Tax Under Pre-ERTA Law*	*Tax Under ERTA*	*Col. 2-Col. 1*	*Percent*** (1.0=100)
Metal Mining	22372868	21242177	−1130691	−0.050538*
Coal Mining	100222640	87719554	−12403086	−0.124753*
Oil, Gas Extr.	445998765	429950890	−16047875	−0.035982*
Nonmet. Min.	33898108	33177267	−720841	−0.021265
Construction	311081148	297353159	−13727989	−0.044130
Food Prdcts.	850030983	793652045	−56378938	−0.066326*
Tobacco	111628411	107619587	−4008824	−0.035912
Textiles	166848933	157175690	−9672973	−0.057974*
Apparel	125759073	121823157	−3935916	−0.031297
Lumber, Wood	51406398	39984489	−11421908	−0.222188*
Furn., Fixt.	68985873	62703296	−6282577	−0.091070*
Paper Prod.	258255568	236081385	−22174183	−0.085861*
Printing, Pub.	282588027	269644048	−12943979	−0.045805*
Chemicals	999528352	899991333	−99537019	−0.099584*
Petrol. Prod.	2390179173	2274210567	−115968606	−0.048519*
Rubber, Plast.	160787359	141241553	−19545806	−0.121563*
Leather Prod.	27314639	26741132	−573507	−0.020996
Stone, etc.	131389841	111793996	−19595845	−0.149143*
Primary Mtls.	362765089	329108628	−33656461	−0.092778*
Fabr. Mtls.	409803800	388198157	−21605743	−0.052722*
Machinery	912370067	875459077	−36910990	−0.040456*
Elect. Equip.	1951590551	1809324804	−142265747	−0.072897*
Trans. Equip.	456055003	398013808	−58041195	−0.127268*
Instruments	225781161	210345397	−15435764	−0.068366*
Misc. Manuf.	114184141	105672945	−8910196	−0.077762*
Transportation	541088065	281428655	−259659410	−0.479884*
Communication	3395262276	3115616500	−279645776	−0.082364*
Utilities	322474988	30521242	−291953746	−0.905353*
Wholesalers	1570201618	1533522530	−36679088	−0.023359
Retailers	8538791689	8464929619	−73862070	−0.008650
Banking	434423260	407354457	−27068803	−0.062310*
Cr. Agencies	149155637	157142486	7986849	0.053547*
Sec,Cmd Brkrs	201274852	201237146	−37706	−0.000187
Insurance	449761276	442026221	−7735055	−0.017198
Ins. Agents	51864266	51497755	−366511	−0.007067
Real Estate	268806560	86001234	−182805326	−0.680063*
Holding Co's	117786830	115732981	−2053849	−0.017437
Services	48684659	42210120	−6474539	−0.132989*

* Significant at the .05 level.
** Column 3 divided by column 1.

extent that ACRS is not inflation-neutral with regard to fixed assets, firms may continue to make behavioral adjustments. Where ACRS depreciation is less than inflation-adjusted depreciation, shorter-lived assets may be substituted for longer-lived ones, capital projects may require higher real rates of return, etc. Where an industry's ACRS depreciation is greater than inflation-adjusted depreciation, longer-lived assets may be substituted for (normally utilized) shorter-lived assets, capital may be (inefficiently) substituted for labor, etc.

These adjustments may result in economic inefficiency and a dead-weight loss to the economy.

Although not neutral on a macro basis, ACRS will significantly correct for underdepreciation in many industries. Unfortunately, it will overcompensate for underdepreciation in capital-intensive industries. These disproportionate benefits during inflationary periods will result in large direct shifts in capital across industries, which indicates the horizontal inequity of ACRS. This effect may be exacerbated by indirect wealth transfers to more tax-favored industries. Both of these shifts in capital would result in economic inefficiency and a deadweight loss to the economy. It is ironic that ACRS was created to promote economic growth through capital formation, yet its dead-weight loss to the economy may have diminished or offset any welfare gain through economic growth.

APPENDIX 1

EQUATIONS OPERATIONALIZED TO DETERMINE INFLATIONARY MISSTATEMENT

T^*, or "inflation-neutral" tax, can be expressed as:

$$T^* = ETR_i[S^* - COGS^* - DPCN^* - OPEX^* \pm MONL], \tag{A1}$$

where:

$$S^* = \frac{X^*_t}{X_t} S_t P_t \tag{A2}$$

$$COGS^* = \frac{X^*_t}{X_t} S_t(DC_{t-a}) + MOH^*_{d,t} \tag{A3}$$

$$DPCN^* = \sum_{j=i}^{L} \gamma_j \frac{X^*_t}{X^*_{t-j}} l_{t-j} \tag{A4}$$

$$OPEX^* = \frac{X^*_t}{X_t} OPEX \tag{A5}$$

$$MONL = \left(\frac{X^*_t}{X^*_{t-1}} - 1\right)(C_t - D_t) \tag{A6}$$

where $MONL$ is added if a gain, subtracted if a loss and:

$$MOH^*_{d,t} = \frac{1}{S_t} \sum_{j=1}^{L} \gamma_j \frac{X^*_t}{X^*_{t-j}} l'_{t-j} \tag{A7}$$

and Total GPL Depreciation $= DPCN^* + MOH^*_d$ (A8)

where all subscripts refer to period t, and X_t and X^*_t are average price levels during the year and at the end of the year, respectively.

a=Average time lag between purchase of direct materials, incurrence of direct labor costs, and incurred of overhead and sale of finished product ($b=0$ for no beginning inventory under LIFO).
C=Monetary assets.
$COGS^*$=Cost of goods sold (restated).
D=Liabilities.
DC=Direct manufacturing costs (materials, labor, and overhead other than depreciation).
ETR_i=Industry effective tax rate.
I=New investment for tax purposes assumed to be acquired at the end of the year (selling and administrative assets).
$DPCN^*$=Depreciation (restated).
MOH_d=Per-unit cost of depreciation expense charged to manufacturing overhead (see equation one).
$MONL$=Monetary gain or loss.
$OPEX^*$=Operating expenses (restated).
P=Sales price per unit.
S^*=Sales (restated).
S=Sales of product in real units.
γ_j=Depreciation fraction for assets purchased j years ago.

Pre-ERTA tax, $T(US)$, can be expressed as:

$$T(US)=ETR[S-COGS-DPCN-OPEX], \tag{A9}$$

$$S=S_tP_s, \tag{A10}$$

$$COGS=S_t(DL_{t-a})+MOH_d, \tag{A11}$$

$$DPCN=\sum_{j=i}^{L}\gamma_j l_{t-j} \tag{A12}$$

where S, $COGS$, $DPCN$, and $OPEX$ refer to (unadjusted for inflation) sales, cost of sales, depreciation, and operating expenses, respectively.

Post-ERTA tax, $T(ERTA)$, is shown as:

$$T(ERTA)=ETR_i[S-COGS'-DPCN'-OPEX]\pm\Delta ITC \tag{A13}$$

$$S=S_tP_s, \tag{A14}$$

$$COGS'=S_t(DC_{t-a}+MOH_{d1,t}+MOH_{d2,t}) \tag{A15}$$

$$DPCN'=\sum_{j=i}^{L}\gamma_j l_{j,t-j}+\sum_{j=i}^{L}\gamma_j l_{i,t-j} \tag{A16}$$

where

MOH_{d1}=Per-unit cost of depreciation expense charged (attributed to pre-ERTA property) to manufacturing overhead.
MOH_{d2}=Per-unit cost of depreciation expense charged (attributable to post-ERTA property) to manufacturing overhead.
l_j=Old assets (not subject to ERTA).
l_i=New assets (subject to ERTA).
ΔITC=The change in investment tax credit resulting from the change to ERTA from pre-ERTA tax law.

$$\text{Total ACRS Depreciation} = DPCN' + (MOH_{d1,t} + MOH_{d2,t})S_t \tag{A17}$$

The foregoing three equations are for manufacturers. For merchandisers and service industries, equation (A3) would be corrected by:

$$COGS^* = \frac{X_t^*}{X_t} S_t(PRCH_{t-a}) \text{ if a merchandiser,} \tag{A18}$$

$$= 0 \text{ if a service industry}$$

where $PRCH$ is the per-unit cost of merchandise purchased for resale.

Equations (A13) and (A15) would be corrected by:

$$COGS = S_t(PRCH_{t-a}) \text{ if a merchandiser,} \tag{A19}$$

$$= 0 \text{ if a service industry.}$$

Inflation-neutral tax, by assumption deflated, is expressed in real and discounted dollars as:

$$\sum_{t=1}^{20} \frac{1}{(1+Z^i)^t} T^* \tag{A20}$$

where Z^i is a rate of discount in real terms for industry i, or the industry's weighted average after-tax cost of capital for year t.

Deflated and discounted pre-ERTA tax for the 20-year simulation can be expressed as:

$$\sum_{t=1}^{20} \frac{1}{(1+Z^i)^t} \frac{\partial}{\partial X^*_t} \frac{T(US)_{t+i}}{X^*_{t+i}} \tag{A21}$$

Deflated and deflated discount taxes for post-ERTA law can be expressed as:

$$\sum_{t=1}^{20} \frac{1}{(1+Z^i)^t} \frac{\partial}{\partial X^*_t} \frac{T(ERTA)_{t+i}}{X^*_{t+i}} \tag{A22}$$

Deflated, discounted GPL depreciation can be shown as:

$$\sum_{t=1}^{20} \frac{1}{(1+Z^i)^t} \frac{\partial}{\partial X^*_t} \frac{DPCN^* + MOH^*_d}{X^*_{t+i}} \tag{A23}$$

Tax-effected, deflated, and discounted GPL depreciation is simply equation (A22) multiplied by ETR_i. Scaled, after-tax, deflated, and discounted GPL depreciation is simply equation (A22) multiplied by ETR_i and divided by the industry's total fixed assets for each year.

Deflated, discounted ACRS depreciation is:

$$\sum_{t=1}^{20} \frac{1}{(1+Z^i)^t} \frac{\partial}{\partial X^*_t} \frac{DPCN' + (MOH_{1,t} + MOH_{d2,t})S_t}{X^*_{t+i}} \tag{A24}$$

Tax-effected, deflated, and discounted ACRS depreciation is simply equation (A23) multiplied by ETR_t. Scaled, after-tax, deflated, and discounted ACRS depreciation is simply equation (A23) multiplied by ETR_t and divided by the industry's total fixed assets for each year.

APPENDIX 2

INFLATIONARY ASSUMPTIONS

Box-Jenkins Forecasts of GNP Implicit Price Deflator (1980 = 1.0)

Year	*Forecast*	*Actual*
1981	1.06575	1.09313
1982	1.13227	1.19636
1983	1.20518	1.26594

Randomly Selected Historical Rates of Change in GNP Implicit Price Deflator (in Cumulative Deciles)

.890	1.020	1.073
.985	1.030	1.094
1.014	1.043	1.156
1.017	1.054	

APPENDIX 3

VALIDATION OF SIMULATION RESULTS OVERALL TREATMENT MEANS: ACRS VS. GPL DEPRECIATION ASSUMING RANDOM INFLATION

	ACRS	*GPL*
Undiscounted Depreciation	6145.50	5615.70
Discounted Depreciation	14353.00	12610.00
Scaled, Discounted Depreciation*	5.36	4.58
Tax Effect of Scaled, Discounted Depreciation	2.11	1.76

* Means do not differ at .05 using Dunn's multiple comparison procedure. Means derived from data (in trillions of 1980 dollars) subjected to Box-Cox power transformation.

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NOTES

The Properties of Sequential Regressions with Multiple Explanatory Variables

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ABSTRACT: The sequential treatment adopted in many multiple signal studies is consistent with a simultaneous treatment and with other apparently diverse sequential approaches. More importantly, the conventional residual security return research design, which is also a sequential approach, can lead to downward-biased estimates of the incremental explanatory power of the accounting variables introduced at the second stage. This finding is striking in that it implies that the most pervasive use of a sequential approach is likely to lead to biased results.

RECENTLY Christie et al. [1984] examined the properties of a sequential treatment of multiple accounting signals by comparing the properties of a sequential two-stage linear regression with those of a multiple regression model.[1] The domain of studies that have adopted a two-stage regression approach to multiple accounting signals is probably less than ten. The domain of multiple accounting signal research is much larger, although most of it has not explicitly adopted a regression approach. The properties of this larger body of research are potentially of greater interest, because the desire to incorporate multiple accounting signals is a generic problem in accounting research. A prominent characteristic of this research is also a sequential treatment of the multiple accounting signals. However, a sequential treatment of multiple explanatory variables is even broader and extends to accounting research that has used residual security returns, a body of research that encompasses several hundred studies.

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[1] The term *signal* is used throughout without necessarily implying any similarity to the usage of the term in the signaling literature. Moreover, the use of the term does not imply that the discussion is intended to apply only to studies that adopt an informational rather than an income measurement perspective. Indeed, the term *variable* could have been used throughout in its place.

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This note illustrates two points: (1) Although the sequential treatment adopted in many multiple accounting signal studies differs from that of the studies discussed by Christie et al., it also typically leads to the same inferences as would be drawn from a simultaneous approach; (2) More importantly, the conventional residual return research design is also a sequential approach but can lead to downward-biased estimates of the incremental explanatory power of the accounting variables introduced at the second stage. This finding is striking in that it implies that the most pervasive use of a sequential approach is likely to lead to biased results.

The first section discusses the alternative expressions involving several variables. The second section examines the class of multiple signal research that does not explicitly adopt a regression framework. The third section presents the properties of residual returns as conventionally computed, discusses the potential bias, and offers an alternative measure of residual return.

ALTERNATIVE EXPRESSIONS INVOLVING SEVERAL VARIABLES

This section illustrates the properties of alternative characterizations of the multivariate distribution involving three or more variables. The major purpose of this section is to illustrate the relation between various sequential (two-stage) and simultaneous (single-stage) treatments of the two explanatory variables. This section provides the basis for synthesizing the accounting research to be discussed in the subsequent sections.

For convenience of discussion, Y denotes the "dependent" variable (e.g., a security return variable), and there are two "explanatory" variables,[2] X_1 and X_2. A series of two-variable and three-variable equations are specified in Figure 1.[3] There is not a unique way to characterize the multivariate distribution. All equations in Figure 1 are valid characterizations of the multivariate distribution among the three variables. A linear characterization of the multivariate relation is possible, even though nonlinear dependencies may be present among the variables. By construction, the residuals are uncorrelated with the respective independent variables in that regression. Moreover, the coefficients on the variables in each equation are those that minimize the variance of the residuals.[4]

Equation (5) represents a single-stage, multiple regression equation with X_1 and X_2 as independent variables and is the form most frequently encountered in introductory econometric treatments of multiple explanatory variables.

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[2] In this section, the parameters refer to population values and are assumed to be observed without error. Estimation issues are beyond the scope of the current discussion.

[3] For ease of discussion and without loss of generality, the convention of suppressing the intercept term is adopted. Equations (1) through (8) also appear in Christie et al. Equations (9) and (10) do not appear in Christie et al., although private correspondence from J. Patell discusses properties of these equations.

[4] As Beja [1972] and Fama [1973] have pointed out, almost any multivariate distribution can be characterized in a linear fashion. A random variable can always be linearly projected onto another variable such that the resulting "residual" term is uncorrelated with (i.e., orthogonal to) that other variable. The coefficients that minimize the variance of the residual component equal the ratio of the covariance of the two variables to the variance of the second variable. More generally, with respect to a distribution involving N explanatory variables, the coefficient on the Nth "explanatory" variable depends upon the bivariate distribution between the dependent variable and Nth variable, *conditional upon the other N-1 variables*. The coefficient equals the ratio of the conditional covariance to the conditional variance, which is illustrated in Figure 1 for the case of two explanatory variables. From the perspective of the multivariate distribution, labeling one of the variables as "dependent" and the others as "explanatory" is arbitrary. Presumably, the context facing the researcher motivates the labeling. If the researcher wishes the residual component to be independent of the explanatory variables, further distributional restrictions are required. Multivariate normality is commonly assumed.

FIGURE 1

ALTERNATIVE EXPRESSIONS INVOLVING SEVERAL VARIABLES

Equations

(3) $Y=\beta_1X_1+\breve{\delta}_2Z_2+\epsilon$ where $Z_2=X_2-\alpha_1X_1$ (1)

(4) $Y=\breve{\delta}_1Z_1+\beta_2X_2+\epsilon$ where $Z_1=X_1-\alpha_2X_2$ (2)

(5) $Y=\breve{\delta}_1X_1+\breve{\delta}_2X_2+\epsilon$

(6) $Y=\beta_1X_1+U_1$

(7) $Y=\beta_2X_2+U_2$

(8) $U_1=\delta_2X_2+\omega$

(9) $U_1=\breve{\delta}_2Z_2+\epsilon$

(10) $U_2=\breve{\delta}_1Z_1+\epsilon$

Identities

$$\breve{\delta}_1(4)=\breve{\delta}_1(5)=\breve{\delta}_1(10)=\frac{\delta(Y,X_1|X_2)}{\sigma^2(X_1|X_2)}=\frac{\delta(U_2,Z_1)}{\sigma^2(Z_1)}$$

$$\breve{\delta}_2(3)=\breve{\delta}_2(5)=\breve{\delta}_2(9)=\frac{\delta(Y,X_2|X_1)}{\sigma^2(X_2|X_1)}=\frac{\delta(U_1,Z_2)}{\sigma^2(Z_2)}$$

$\epsilon(3)=\epsilon(4)=\epsilon(5)=\epsilon(9)=\epsilon(10)$

$\beta_1(3)=\beta_1(6)$

$\beta_2(4)=\beta_2(7)$

Equations (1) through (4) represent a set of two-stage approaches. In the first stage represented by equations (1) and (2), X_2 is transformed into Z_2, such that X_2 is orthogonal to (i.e., uncorrelated with) X_1 by construction and is represented by equation (1), where it is a residual from a linear projection of X_2 on X_1. Analogous statements can be made with respect to Z_1. Equations (3) and (4) represent second-stage equations that include two variables, one of the original explanatory variables and the orthogonalized portion of the other explanatory variable.

Christie et al. [1984] have pointed out that the coefficients on the transformed variables ($\breve{\delta}_1$ and $\breve{\delta}_2$) in the two-stage equations of (3) and (4) are equal to the coefficients obtained from the single-stage equation (5).[5] The identity occurs because the multiple regression approach of equation (5) implicitly involves an orthogonalization procedure, which is explicit in the two-stage approaches. Beaver and Landsman [1983] (BL) is an illustration of such research.[6]

However, equations (6) through (10) represent another form of two-stage approach. Equations (6) and (7) represent the first stage where Y is transformed into a residual $U_1(U_2)$ such that it is orthogonal to $X_1(X_2)$. Equations (8), (9), and (10) represent the second stage where the residual obtained from the first stage equations [(6) and (7)] becomes the dependent variable in the second stage. In the second stage [equations (9) and (10)], the explanatory variable has also been orthogonalized with respect to X_1 and X_2, respectively. As is shown in Figure 1, the sequential two-stage approach of equations (6) and (9) [(7) and (10)] is equivalent to equation (5) or equations (1) and (3) [(2) and (4)] in the sense that the coefficients at the second stage (δ_1 and δ_2) are equivalent to those appearing in equations (3) through (5). As shown below, it is this alternative two-stage approach that characterizes many multiple accounting signal studies, as well as the conventional residual return approach.

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[5] Note that $\breve{\delta}_2$ is identical in equations (3), (5), and (9). By definition $\breve{\delta}_2=\sigma(Y,Z_2|X_1)/\sigma^2(Z_2|X_1)$, $\breve{\delta}_2=\sigma(Y,X_2|X_1)/\sigma^2(X_2|X_1)$, and $\breve{\delta}_2=\sigma(U_1,Z_2)/\sigma^2(Z_2)$, in (3), (5), and (9), respectively. However, the $\sigma(Y,Z_2|X_1)=\sigma(Y,X_2|X_1)=\sigma(U_1,Z_2)$, since $X_2=\alpha_1X_1+Z_2$, $Y=\beta_1X_1+U_1$, and $\sigma(U_1,X_1)=\sigma(Z_2,X_1)=0$ by construction. Similarly, $\sigma^2(Z_2|X_1)=\sigma^2(X_2|X_1)=\sigma^2(Z_2)$, since $X_2=\alpha_1X_1+Z_2$ and $\sigma(Z_2,X_1)=0$ by construction.

[6] Two other studies that adopt a regression approach are Brown, Finn, and Hancock [1977] and Brown, Foster, and Noreen [1985].

Multiple Accounting Signals Using a Sequential Approach

Multiple signal studies constitute a major element of capital market research in accounting. The growth of such studies is a natural evolution of earlier work that examined various aspects of the bivariate distribution of a security return metric and a signal of interest (e.g., historical cost earnings). It is inevitable that the research would recognize that in many contexts a variety of signals is being released simultaneously, which leads the research design to consider the multivariate distribution among returns and the signals. For the most part, this literature does not explicitly adopt a multiple regression model.[7]

The research designs of prior multiple accounting signal research share three prominent features: a sequential treatment of explanatory variables, no explicit adoption of a regression approach, and the influence of the single explanatory studies that preceded them. The influence of prior research on the design of subsequent research is hardly surprising, nor is it in and of itself a criticism of subsequent research. Indeed, systematic alteration of research designs provides a control mechanism and facilitates comparison with previous research. Knowledge of the nature of this dependence across studies can provide a perspective to help understand why a particular study adopted the research design it did.

A prominent example is Foster's [1975] study.[8] The research design of the Foster study is heavily influenced by prior research on the bivariate relation between security returns and earnings. The heritage is that of Ball and Brown [1968], and the Foster study can be viewed as a natural extension to a multiple signal context. A key feature of the Foster research design is a sequential consideration of three components of insurance company earnings: underwriting earnings (U), investment income (I), and capital gains and losses (C). In turn, each earnings component is treated as dichotomous (positive and negative forecast error). As in BL, the purpose of the analysis is to examine the incremental explanatory power of additional explanatory variables. Evidence is provided on the incremental explanatory power of I beyond that provided by U. Evidence is also provided on the incremental explanatory power of C beyond that provided by U and I.

The sequential treatment of the explanatory variables adopted by Foster is analogous (and with some modification, equivalent) to the two-stage approach represented by equations (6) and (9). The portfolio construction procedure of Foster is analogous to orthogonalizing both security returns and the second accounting signal with respect to the first accounting signal, and then examining whether there is any dependence between the two orthogonalized variables.[9]

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[7] These features are not a complete description of the research design of multiple signal studies. The intention is to highlight those aspects of the research design that are relevant to the present discussion.

[8] Other examples of multiple signal research include the earnings-dividends studies by Watts [1973], Griffin [1976], and Gonedes [1978], among others.

The analogy to a two-stage approach as characterized in equations (6) and (9) is not perfect because the explanatory variables are dichotomous. The use of a dichotomous variable permits the researcher to be silent on the nature of the relation between the magnitude of the earnings variables and the dependent variable (e.g., no assumption of linearity is required). If these studies had treated the explanatory variables as continuous, their sequential procedure would be essentially equivalent to the two-stage approach characterized by equations (6) and (9).[10] The coefficient obtained from equation (9) is δ_2, which is identical to the coefficient obtained from the two-stage approach adopted in BL [i.e., using equation (3)] and from the multiple regression approach of equation (5). In other words, the sequential approach adopted by Foster is equivalent to other two-stage approaches as well as to a simultaneous approach.

RESIDUAL RETURN ANALYSIS

The issue is much more pervasive than would be inferred by looking only at the multiple signal literature. The analysis applies equally to other multiple explanatory variable contexts. Most prominently, the use of residual security returns or some similar return metric, widely used in capital market research in accounting from Ball and Brown to recent efforts, is an example of a sequential approach in a multiple explanatory variable context.

Moreover, the analysis so far has suggested that the sequential treatment of multiple explanatory variables can be viewed as equivalent in many respects to a single-stage, simultaneous treatment, for the purposes of assessing incremental explanatory power of the variables of interest.

Residual return can be characterized as a two-stage regression approach represented by equations (6) and (8). The security return is Y, the market return is X_1, the residual return is U_1, and the informational variable (e.g., earnings) is $X_2(Z_2)$. Hence, a sequential, two-stage approach to the treatment of multiple explanatory variables has been a major part of the research design tradition since 1968. The coefficient in equation (8) is δ_2, which does not appear in any of the other equations.

While equations (6) and (8) characterize the residual return approach as it has been applied, it is worthwhile to compare this pair of equations with equations (6) and (9), which are another form of residual return approach. Equation

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[9] Foster did not literally conduct such regressions. The Foster research design differs in two respects: (1) It does not assume a linear relation between security returns and the accounting signals; and (2) It groups data into portfolios. However, neither precludes a regression interpretation.

[10] Foster recognizes that the explanatory variables are not naturally dichotomous. As a result, the second explanatory variable may possess a significant coefficient because it is a proxy for the magnitude of the first explanatory variable. For example, holding the sign of the earnings forecast error constant is not the same as holding the magnitude of the forecast error constant. Foster examines the "success" of suppressing variation in the first variable by examining the average value of the first variable across portfolios. However, unless further assumptions are made about the nature of the distribution (e.g., linearity), holding the average value constant across portfolios is neither necessary nor sufficient for suppressing the influence of the first explanatory variable on the dependent variable or on the second explanatory variable. While the use of dichotomous variables has the apparent advantage of not assuming linearity, it also potentially "throws away" information contained in the magnitude of the variables. Also, as the number of variables and number of groups increases, the grouping procedure becomes cumbersome at best.

(9) differs from (8) in that the independent variable is Z_2 rather than X_2. The residual component from (9) is equal to the residual component obtained from the other two-variable approaches, equations (3) through (5). *Most importantly, the coefficient on* Z_2 *is equal to the respective coefficient* ($\tilde{\delta}_2$) *in equations* (3) *and* (5).

In contrast, the sum of the squared residuals from equation (8) is greater than that from (3), (4), (5), (9), and (10). *More importantly, the coefficient* δ_2 *is not equal to equation* (8) *and can be viewed as a biased assessment of the incremental explanatory power of* X_2 (*i.e.,* $\tilde{\delta}_2$). The residual return by construction is orthogonal to X_1. As a result, any variation in X_2 associated with variation in X_1 cannot possibly explain any of the variation in the residual return. Any incremental explanatory power of X_2 must be contained in its component that is orthogonal to X_1 (i.e., must be contained in Z_2). From this perspective, X_2 can be characterized as measuring Z_2 with error, with the well-known effects. The coefficient is biased toward zero (hereafter, downward-biased) and the sum of the squared residuals (SSE) is larger relative to that attainable under a specification that does not contain error [e.g., equation (9)].

More precisely, the slope coefficient in (8) is expected to be closer to zero than $\tilde{\delta}_2$ (i.e., $|\tilde{\delta}_2| - |\delta_2| > 0$). $\tilde{\delta}_2$ has a natural interpretation as the incremental explanatory power of X_2, because

$$\begin{aligned}\tilde{\delta}_2 &= \sigma(X_2, Y | X_1)/\sigma^2(X_2 | X_1)\\ &= \varphi(U_1, Z_2)/\sigma^2(Z_2).\end{aligned}$$

The coefficient, δ_2, which equals $\sigma(U_1, X_2)/\sigma^2(X_2)$, has no such natural interpretation. The numerator is equal to that of $\tilde{\delta}_2$, but the denominator is larger [i.e., $\sigma^2(X_2) = \sigma^2(Z_2) + \alpha_1{}^2\sigma^2(X_1)$]. As such, δ_2 constitutes a biased assessment of $\tilde{\delta}_2$. Of course, the researcher must decide what the parameter of interest is. However, I interpret prior research, at least my own, as being interested in assessing $\tilde{\delta}_2$ rather than δ_2.

Needless to say, this has potentially important implications for the widely-used residual return approach. It has long been known that the sequential, two-stage approach of residual returns potentially reduced the explanatory power of earnings by letting the market return enter in the first stage (see Beaver [1981], among others). More precisely, $\tilde{\delta}_2$ may not be equal to β_2 [from equation (6)] and the increase in the proportion of variance explained (R^2) in moving from equation (6) to equation (5) may be less than the R^2 in equation (7). But, after all, that is what is meant by "incremental explanatory power." The point being made here is fundamentally different. It states that the prevailing method of assessing the incremental explanatory power of accounting variables via the conventional residual return approach is a downward-biased estimate of $\tilde{\delta}_2$. The conventional approach is expected to understate the incremental explanatory power, in terms of using δ_2 to assess $\tilde{\delta}_2$ or in terms of examining the R^2 associated with equation (8) instead of that associated with equation (9).[11]

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[11] Although estimation issues are beyond the scope of the current discussion, the second-stage equations (8) through (10) are estimating the coefficient with $N-k-1$ degrees of freedom, where N is the number of observations and k is total number of explanatory variables in both stages. Yet most empirical studies, as well as most "canned" regression programs, "forget" that degrees of freedom have been used up in estimating the coefficient in the first stage [i.e., equations (6) and (7)]. This may not be a serious problem when N is large and when only one variable (e.g., the return on a market portfolio) appears in the first stage. However, for "small" N or when a large number of variables have been used at the first stage (e.g., multi-factor model security returns in the first stage), the problem can become serious. The result of underestimating the effective degrees of freedom is to overestimate the t-values and implied levels of significance.

What are the implications? Does it imply that all of the residual return studies have to be repeated using equation (9), rather than equation (8)?[12] Hardly. Many studies, Ball and Brown [1968] among others, were able to find significant incremental explanatory power, in spite of a potential understatement of the effect. However, other studies have not been as fortunate. Here, the potential downward bias could have influenced the results. Moreover, if the researcher is interested in the magnitude of the coefficient (δ_2), then equation (8) provides a biased estimate of that coefficient, even if the estimate of δ_2 is significantly different from zero.

CONCLUDING REMARKS

This note illustrates two points: (1) The sequential treatment adopted in many multiple signal studies is consistent with a simultaneous treatment and with other apparently diverse sequential approaches. (2) The conventional residual return approach is another example of sequential treatment of multiple explanatory variables. From this perspective, the conventional residual return approach can be viewed as providing a downward-biased estimate of the incremental explanatory power of the accounting variables introduced in the second stage. This finding is striking in that it implies that the most pervasive use of a sequential approach is likely to lead to biased results.

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[12] Alternatively, equations (3) or (5) could be used to assess δ_2. Recently, research designs have moved away from a residual return approach. Instead, security return is the dependent variable. In a time series application, such as Larcker et al. [1980] or Schipper and Thompson [1983], the return on a "market" portfolio is one of the explanatory variables. In a cross-sectional context, such as Brown, Foster, and Noreen [1985], beta is one of the explanatory variables.

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A Test of Audit Pricing in the Small-Client Segment of the U.S. Audit Market

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ABSTRACT: Simunic [1980] and Palmrose [1986, Appendix A] report contradictory findings about a Big Eight auditor price premium in the "small" auditee segment of the U.S. audit market for publicly-traded companies. The study reported here finds that a Big Eight price premium exists and that the premium exists with respect to both second-tier national firms and local/regional firms. The existence of a price premium implies Big Eight product differentiation, at least in the "small" auditee market segment. A separate test is made of initial audit engagements. Tests indicate that initial engagements are priced significantly lower than continuing engagements, which supports recent reports of price-cutting behavior. However, no inference is made about the effect of price-cutting on audit quality.

SEVERAL studies have investigated the effect of audit firm size on companies' audit fees (see Table 1). The approach taken has been to do a cross-sectional regression of audit fees on a set of explanatory variables. Audit firm size is included in the model as the experimental independent variable of interest and is coded one for large audit firms and zero for small audit firms. The sign of the auditor size variable is used to make inferences about the relationship between audit firm size and audit fees. A positive, significant coefficient indicates a price premium for large audit firms. Large audit firms have usually been defined as the well-known Big Eight.[1]

Table 1 summarizes four U.S. studies, two Australian studies, and one each from New Zealand and the U.K. The studies have used different fee models on different samples of publicly-traded companies from different countries at different points in time. Yet in spite of these differences, two consistent results can be observed across the studies. First, for comparable samples of very large companies (mean assets over $600 million), the auditor size variable is not significant [Francis and Stokes, 1986; Palmrose, 1986; Simon, 1985; and Simunic, 1980]. Only Maher et al. [1985] report a significant association between audit firm size and audit fees for large

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[1] The Big Eight firms are: Arthur Andersen, Arthur Young, Coopers and Lybrand, Deloitte Haskins and Sells, Ernst and Whinney, Peat Marwick Mitchell, Price Waterhouse, and Touche Ross.

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TABLE 1
SUMMARY OF AUDIT PRICE RESEARCH

	Simunic [1980]			*Palmrose [1985]*			*Simon [1985]*	*Maher et al. [1985]*
	Total	*Small Auditees*	*Large Auditees*	*Total*	*Small Auditees*	*Large Auditees*	*Total*	*Total*
Sample size	373	171	202	361	177	184	173[2]	109
Big Eight	264	100	164	298	121	177	137	105
Non-Big Eight	109	71	38	63	56	7	36	4
Country		United States			United States		United States	United States
Data Year		1977			1980–81		1978–83	1981
Size Cutoff	NA	Sales < $125MM	Sales > $125MM	NA	Assets < $150MM	Assets > $150MM	NA	NA
Mean Assets	$551MM	$177MM	$892MM	$1,260MM	$40MM	$2,433MM	$2,701MM	$3,577MM
Big Eight Variable	—*[1]	NS	NS	+*	+*	NS	NS[3]	—*

	Francis [1984]			*Francis and Stokes [1986]*		*Firth [1985]*	*Taffler and Ramalinggam [1982]*
	Total	*Small Auditees*	*Large Auditees*	*Small Auditees*	*Large Auditees*	*Total*	*Total*
Sample size	136	68	68	96	96	96	192
Big Eight	64	31	33	39	71	NR[4]	119[6]
Non-Big Eight	72	37	35	57	25	NR	73
Country		Australia		Australia		New Zealand	Great Britain
Data Year		1974–78		1983		1981 & 1983	1976

TABLE 1—*Continued*

Size Cutoff	NA	Assets< $17.8MM	Assets> $17.8MM	Smallest Public Firms	Largest Public Firms	NA[5]	NA
Mean Assets	$49MM(Aus)	$8MM(Aus)	$90MM(Aus)	$1.8MM(Aus)	$603MM(Aus)	$65MM(NZ)	£36.5MM[7]
Big Eight Variable	+*	+*	+*	+*	NS	NS	+*[6]

Key:
NA = not applicable
NR = not reported
NS = not significant
MM = millions
* = significant at $\alpha = .05$ or less

[1] Price Waterhouse is treated as a separate firm but is NS in the main tests.

[2] The 173 observations come from 79 firms over the period 1978–1983.

[3] An auditor variable was used only for Price Waterhouse.

[4] Touche Ross and Arthur Andersen are excluded so only the "Big Six" are used.

[5] The sample was split at the median of assets into "upper/lower" halves but the separate results are not reported as they apparently are the same as pooled results.

[6] Large firms are defined as the Big Eight *plus* seven other "large" firms. The sign actually is negative; however, the variable is coded the opposite of other studies, that is, 1 = small firms, 0 = large firms.

[7] This number is median sales rather than mean assets as the latter are not reported.

auditees; however, since only four non-Big Eight firms are in the sample, the results lack generality. So for samples of unambiguously large companies, the auditor size variable is not significant. The second point that emerges from Table 1 is a finding of a significant positive association between audit firm size and audit fees for samples of relatively small companies (mean assets less than $100 million) [Francis, 1984; Francis and Stokes, 1986; Palmrose, 1986; and Taffler and Ramalinggam, 1982]. Firth [1985] did not find a significant difference, though this may be attributable to uniqueness in the New Zealand market, nor did Simunic [1980] for a sample of somewhat larger U.S. companies (mean assets of $177 million).[2]

The purpose of the study reported here is to provide further evidence on audit pricing in the small-client segment of the U.S. audit market for publicly-traded companies. This is important because of the contradictory findings of Palmrose [1986] and Simunic [1980]. Simunic [1980] found no price differences between Big Eight and non-Big Eight auditors in samples of both small and large auditees. However, Palmrose [1986, Appendix A] found that Big Eight prices were higher than non-Big Eight prices for small auditees, though no price differences were observed for large auditees. The use of different fee models, alternative definitions of "small" companies, and data from different time periods in these two studies hinders their direct comparison.

The contradictory findings in the U.S. market are important given the pricing framework developed by Simunic [1980, Table 3, p. 171]. He suggests comparing pricing between small and large auditees because competitive pricing can be assumed for small auditees (due to large numbers of suppliers) but cannot be assumed for large auditees (due to Big Eight concentration and potential cartel pricing). By comparing pricing across these two market segments, inferences can be drawn regarding competition, product differentiation, and economies of scale. Simunic's [1980] results are consistent with a competitive market for both segments and no observed product differentiation or scale economies for the Big Eight firms. Palmrose's [1986] finding of a Big Eight price premium in the small auditee market evidences the existence of Big Eight product differentiation. Francis [1984] and Francis and Stokes [1986] report the same result in the Australian market.[3]

In addition to providing further evidence about product differentiation in the small-client segment of the U.S. audit market, this study uses three classes of audit firm size in addition to the Big Eight/non-Big Eight dichotomy: (1) Big Eight firms, (2) other national firms (the so-called second tier) and (3) all other firms having local or regional practices.[4] The use of three size classes provides a richer test of the association between auditor size and audit fees than in prior audit fee research.

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[2] Firth [1985, p. 24] points out that the international names of accounting firms could be used in New Zealand only after 1983. The implication of this would seem to be less brand-name recognition associated with the Big Eight in New Zealand. Therefore, it is not surprising to find no evidence of product differentiation (higher prices).

[3] Higher Big Eight prices in the small-client segment are clearly consistent with Big Eight product differentiation. The failure to observe higher Big Eight prices (from product differentiation) in the large-client segment could be explained by offsetting lower prices due to scale economies so that the net effect is no observable differences; in other words, *both* Big Eight product differentiation (higher prices) and scale economies (lower prices) exist. See also footnote 10.

[4] The second-tier firms are: Alexander Grant (now Grant Thornton), Fox and Co., KMG Main Hurdman, Kenneth Leventhal, Laventhol and Horwath, McGladry Hendrickson and Pullen, Oppenheim Appel Dixon, Panell Kerr Forster, and Seidman and Seidman. These firms are widely regarded as constituting the second tier and are identified as such in various sources (e.g., *Public Accounting Report, The Accounting Wars* [Stevens, 1985] and the Dingell Congressional hearings

SAMPLE SELECTION AND RESEARCH DESIGN

As is evident from Table 1, size cutoffs for determining "small" auditees have varied considerably across studies. For this study small companies are defined the same as by Simunic [1980]: publicly-traded firms having sales less than $125 million. Audit fee data were collected by a questionnaire sent to a total of 906 companies selected at random from the 1984 Moody's Industrial and OTC Industrial manuals. Data for the independent variables come from annual reports, SEC forms 10-K, and the Moody's manuals.

Usable responses were received from 210 firms for a response rate of 23 percent. The sample is well dispersed across industries. A total of 44 two-digit SIC codes are represented. An additional ten companies meeting the size criteria were added to the sample from the data source described in Simon [1985]. The final sample consists of 220 companies and the data for audit fees and all independent variables come from fiscal years ending from January 1, 1984 through June 30, 1985. Twelve respondents represented initial audit engagements. These 12 companies are not included in the basic tests, but are evaluated separately later in the paper.

Audit fees are regressed on a set of explanatory variables that includes the experimental variable audit firm size. The following variables have been found to be statistically significant in audit fee models for small companies in prior studies: auditee size (assets), number of subsidiaries, diversification, percentages of assets in receivables and inventories, amount of foreign assets, risk measures (equity-debt ratio, unsystematic risk, and operating losses), and the type of audit report.

The final fee model selected is the following parsimonious model:[5]

$$\begin{aligned}\text{LOGFEE} = {} & b_0 + b_1\,\text{LOGASSETS} \\ & + b_2\text{SQSUBS} \\ & + b_3\text{FOREIGN} + b_4 \\ & \text{INVREC} + b_5\ \text{OPINION} \\ & + b_6\ \text{AUDITOR} + \epsilon\end{aligned}$$

where the dependent variable is the natural logarithm of audit fee and the explanatory variables are:

LOGASSETS = natural logarithm of total assets,
SQSUBS = square root of the number of consolidated subsidiaries,
FOREIGN = the proportion of foreign subsidiaries to total subsidiaries,
INVREC = the proportion of assets in inventories and receivables,
OPINION = a dummy variable having a value of 1 if the firm received a "subject to" audit opinion, and
AUDITOR = two codings as explained below.

The first five explanatory variables are related to auditee size (LOGASSETS),

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[*Journal of Accountancy*, December 1985, pp. 39–40]). In 1985 Alexander Grant and Fox and Co. merged, but they are treated here as two separate firms since no audits in the sample were done by the merged firm.

[5] Two risk measures, debt-equity ratio and the existence of operating losses, were tried and were not significant so they were excluded from the final model. However, the loss variable was correlated with OPINION ($r = .36$), so the model was estimated with the loss variable in lieu of OPINION. The loss variable was significant at $\alpha = .10$ but other variables were substantially unchanged.

audit complexity (SQSUBS and FOREIGN), and audit risk (INVREC and OPINION). Following earlier studies, these variables are expected to be positively related to audit fees. See Simunic [1980] and Francis [1984] for a discussion of the variables. Additionally, to assess whether fees differ among groups of auditors, two different auditor variables are used:

BIG EIGHT = 1 if the auditor is one of the Big Eight firms, and
NATIONAL = 1 if the auditor is one of the nine second-tier firms.

The residual error term, ϵ, is assumed to have the standard properties.

To compare audit pricing across the three sizes of audit firms, the above auditor variables are used in the following tests on subsamples of the total sample:

1. Big Eight vs. national auditors
2. Big Eight vs. local/regional auditors
3. National vs. local/regional auditors.

For each of the above three OLS estimates, the auditor variable is coded one for the larger auditors and zero for the smaller auditors. Two additional regressions use the full sample:

4. Big Eight vs. all non-Big Eight auditors
5. Big Eight vs. national vs. local/regional auditors.

Regression 4 uses only the BIG EIGHT auditor variable and regression 5 uses both BIG EIGHT and NATIONAL auditor variables. Regression 5 allows for a simultaneous test of all three size groups (Big Eight vs. non-Big Eight and national vs. local/regional) whereas regressions 1 through 4 represent subsample tests of alternative auditor size pairings.

RESULTS

Descriptive statistics are reported in Table 2 for variables in the OLS fee model. Mean assets are $30 million, which makes this sample considerably smaller in average firm size than Simunic [1980] and somewhat smaller than Palmrose [1986] who had average assets of $177 million and $40 million, respectively. The Big Eight audited 62 percent of the sample, which is comparable to both Simunic [1980] and Palmrose [1986] who had 59 percent and 68 percent, respectively. Tests were also performed to examine whether clients of Big Eight and non-Big Eight auditors were similar in terms of the other explanatory variables. While this condition is not necessary since the regression equation controls for cross-sectional differences, it provides additional assurance against confounding results due to model misspecification. *T*-tests were made on the continuous variables and a chi-square classification test on the categorical variable OPINION. None of the variables differed significantly between Big Eight and non-Big Eight auditors ($\alpha = .05$, two-tailed tests).

OLS estimates for each of the five regressions are reported in Table 3. Good linear fits are achieved in the five regressions. Values of adjusted R^2 range from .57 to .63. The predicted positive signs are achieved for all independent variables and all are significant at $\alpha = .10$ or less (with the exception of INVREC and FOREIGN in some of the subsamples). Regression assumptions of normally distributed residuals and constant

TABLE 2
DESCRIPTIVE STATISTICS
($n=208$)

	Total Sample		*129 Firms with Big Eight Auditors*	*79 Firms with non-Big Eight Auditors*
Variable	*Mean (Std. Dev.)*	*Minimum Maximum*	*Mean (Std. Dev.)*	*Mean (Std. Dev.)*
Audit Fee ($thousands)	57.3 (47.7)	6.2 225.0	66.5 (51.7)	46.1 (38.2)
Assets ($millions)	30.0 (35.1)	.4 168.0	33.7 (36.9)	25.9 (32.5)
Subsidiaries	3.25 (4.82)	0 47	3.3 (4.2)	3.3 (6.0)
Foreign	.09 (.19)	0 .89	.10 (.20)	.09 (.18)
Portion of assets in inventory and receivables	.40 (.23)	.01 .91	.39 (.23)	.42 (.23)
Percentage of Firms:				
Receiving a qualified opinion	10%		11%	9%
Audited by:				
Big Eight Firms	62%			
National Firms (Second Tier)	18%			
Local/Regional Firms	20%			

TABLE 3
REGRESSION ESTIMATES

	Coefficients (T-statistics)				
Variable	*Big Eight vs. National (subsample)*	*Big Eight vs. Local/Regional (subsample)*	*National vs. Local/Regional (subsample)*	*Big Eight vs. Non-Big Eight (full sample)*	*Big Eight vs. National vs. Local/Regional (full sample)*
Intercept	2.27	2.31	2.02	2.23	2.25
LOGASSETS	.39 (11.84)*	.38 (12.42)*	.37 (7.89)*	.38 (13.14)*	.38 (13.07)*
SQSUBS	.10 (2.60)**	.09 (2.50)**	.21 (4.14)*	.13 (4.15)*	.13 (4.19)*
FOREIGN	.52 (2.77)**	.63 (3.05)*	.48 (1.48)	.48 (2.74)**	.49 (2.76)**
INVREC	.10 (0.65)	.16 (1.07)	.59 (2.27)**	.24 (1.69)***	.24 (1.67)***
OPINION	.35 (3.02)*	.27 (2.22)**	.34 (1.75)***	.32 (2.92)*	.32 (2.93)*
BIG EIGHT	.26 (2.96)*	.24 (2.80)*		.24 (3.57)*	.22 (2.55)**
NATIONAL			−.05 (−0.43)		−.04 (−0.04)
Sample	$n=168$	$n=173$	$n=75$	$n=208$	$n=208$
Adjusted R^2	.57	.63	.61	.61	.61
F-ratio	38.9*	49.3*	19.9*	55.4*	47.3*

Significance levels (two-tail tests): * = .01; ** = .05; *** = .10.

variance (homoscedasticity) are not violated.[6] Finally, the correlation matrix in Table 4 suggest no collinearity problems between the auditor variables and other independent variables.

The regression estimates reported in Table 3 indicate the existence of a Big Eight price premium. In the test of Big Eight versus all non-Big Eight auditors, the BIG EIGHT coefficient is positive and significant at $\alpha=.05$ (two-tail test). The BIG EIGHT variable is regressed against all other independent variables to assure that it is not simply proxying for other variables in the model. The value of R^2 for this regression is less than .01 indicating no collinearity problems. To determine that the BIG EIGHT coefficient is not driven by one or two firms, a separate auditor variable is used for each Big Eight firm in lieu of the single BIG EIGHT variable. All eight of these vari-

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[6] A null hypothesis that the residuals are normally distributed cannot be rejected at $\alpha=.05$ using a chi-square distribution test. A Goldfeld-Quandt test (see Goldfeld and Quandt [1965]) is used to test for heteroscedasticity. The regression models are run on the upper/lower 40 percent of the sample based on the predicted values of the dependent variable. The null hypothesis is that the sum of squared errors for the upper and lower 40 percent are equal. The calculated F-ratios are not significantly different from 1.0; thus the null hypothesis of homoscedasticity cannot be rejected.

TABLE 4
PEARSON PRODUCT-MOMENT CORRELATIONS
($n=208$)

	LOGASSETS	*SQSUBS*	*FOREIGN*	*INVREC*	*OPINION*	*BIG EIGHT*	*NATIONAL*
LOGASSETS	1.00						
SQSUBS	.34	1.00					
FOREIGN	.21	.28	1.00				
INVREC	−.16	−.01	.15	1.00			
OPINION	.20	.00	−.03	.02	1.00		
BIG EIGHT	.17	.04	.05	−.05	.02	1.00	
NATIONAL	.00	.05	.08	.01	.07	−.60	1.00

ables are positive and five are significant at $\alpha=.10$ or less. Strong inferences cannot be drawn for individual Big Eight firms due to the relatively small number of observations per firm; however, the analysis does indicate that the results are not dominated by only one or two of the Big Eight firms.

The subsample analyses indicate that the Big Eight premium exists with respect to both groups of non-Big Eight auditors. When the model is run on the subsample of firms having either a Big Eight or second-tier auditor, the Big Eight coefficient is positive and significant. The same result occurs for the subsample of firms having either a Big Eight or local/regional auditor. In conclusion, the evidence from this sample supports the existence of a Big Eight price premium over all other auditors in the small-client segment of the U.S. audit market for publicly-traded companies.

There is no evidence of a second-tier price premium with respect to local/regional auditors. When the model is run on the subsample of firms having only second-tier or local/regional auditors, the auditor size variable (NATIONAL) is not significant.

Finally, the regression on the full sample using two auditor variables (BIG EIGHT and NATIONAL) is consistent with subsample results. The BIG EIGHT coefficient is significant, indicating a price premium over all non-Big Eight auditors, and the NATIONAL coefficient is not significant, indicating no premium over local/regional auditors.

FURTHER TESTS

If the regression model used in this study is misspecified (the "true" functional form differs from the specified form), then it could be possible for cross-sectional differences among the independent variables to confound the auditor size variable even though the univariate tests indicated no significant differences between firms with Big Eight and non-Big Eight auditors.[7] In particular, auditee size could be a confounding variable. It is well-known that as auditee size increases there is a greater likelihood of having a Big Eight auditor, and it is therefore possible that the auditor size variable is really picking up a residual auditee size effect (even though auditee size is a covariate in the model). Several analyses demonstrate that this is unlikely to be the case. The full sample was used in these tests (except where noted) and the auditor size variable was BIG EIGHT.

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[7] We thank an anonymous reviewer for drawing this to our attention and for suggesting several of the tests reported in this section.

First, as a general test for misspecification due to non-linearity between LOGFEE and LOGASSETS, a higher-order size term (LOGASSETS squared) was included in the model. The variable was not significant, did not improve R^2, and did not affect the significance of the auditor size variable, all of which suggest that the relationship between audit fee and auditee size is approximately log-linear and that the model is not misspecified in this respect.

Second, a Chow test was made by separately estimating the regression on the upper and lower values of auditee size and comparing the total of the residual sum of squares from these two regressions with the full regression. The F-ratio was 1.96 which was not significant at $\alpha = .05$. Thus, the null hypothesis of no differences in the slopes and intercepts (between the two auditee size groups) cannot be rejected. The Chow test provides evidence that the regression parameters are consistent and hence that the model specification is consistent across the full range of auditee size in the sample.

Third, if auditee size were a confounding variable, an alternative specification of the model would be to deflate audit fee by auditee size (as Simunic [1980] did) rather than including it as an independent variable. When this alternative model was estimated, the BIG EIGHT variable remained positive and significant at $\alpha = .05$.

Fourth, an *ex post* size-matched sample was created wherein firms having a non-Big Eight auditor were matched with firms having a Big Eight auditor. The matching rule was that for each firm having a non-Big Eight auditor, there should be a comparable sized firm having a Big Eight auditor, with a size match of within ten percent of total assets. This procedure resulted in 66 matches or 132 firms with mean assets (standard deviation) of $27.8 (33.4) million and $27.9 (33.5) million for firms with Big Eight and non-Big Eight auditors, respectively. The regression result for this subsample was consistent with the full sample and provides strong evidence that auditee size is not a confounding variable. In fact, the BIG EIGHT variable was significant at $\alpha = .01$.

Fifth, interaction terms were added to the model for the BIG EIGHT dummy variable with each of the other independent variables. The interaction terms deal with the possibility that the auditor dummy variable captures not only intercept differences between regressions for different auditor classes, but also slope effects due to a confounding of auditor size and other independent variables. With the interaction terms in the model, the BIG EIGHT variable remained positive and significant at $\alpha = .05$. Comparable results were obtained for the size-matched subsample of 132 firms. The only interaction terms that were significant were SQSUBS and INVREC, both of which had negative coefficients.

Finally, to deal with the possibility that outliers among the independent variables drove the regression results, the model was re-estimated on a subsample of firms for which *all* continuous variables (LOGASSETS, SQSUBS, FOREIGN, INVREC) had a value within one standard deviation of the sample mean. For this subsample of fairly homogeneous firms, the BIG EIGHT variable again remained positive and significant at $\alpha = .05$.

All of these additional tests support the basic results reported in Table 3. There is no evidence that the Big Eight price premium evidenced in this study is due to model misspecification, confounding effects of independent variables, or outliers among the independent variables.

PRICE-CUTTING ON INITIAL AUDIT ENGAGEMENTS

In addition to the 208 companies on which the Table 2 and 3 results are based, 12 companies replying to the questionnaire represented initial audit engagements. The two regressions reported in Table 3 that use the full sample ($n=208$) are re-estimated using these additional 12 observations and an additional independent variable, CHGAUD, is included in the model. CHGAUD is coded one if the audit is an initial engagement and zero if a continuing engagement.[8]

The reason for this additional test is the continuing interest among both policy makers and academics in audit price-cutting behavior. There is anecdotal evidence of price-cutting [AICPA, 1978, p. 110 and *Wall Street Journal*, 1985] and concerns have been expressed over the adverse effect price-cutting may have on audit quality. However, DeAngelo [1981] argues that low-balling (price cutting is a special case of low-balling—see Francis [1984, footnote 10]) is economically rational and is neutral with respect to audit quality.

CHGAUD is negative and significant in both regressions at $\alpha=.01$ (T-statistic $=-3.04$), and all other independent variables are unchanged in terms of signs and significance levels. While the number of observations is very small, the evidence indicates that initial audit engagements are significantly lower in price than are continuing engagements. However, while price-cutting behavior is observed, no interpretation is made as to the effect of price-cutting on audit quality.[9]

CONCLUSION

The main purpose of this study was to provide further evidence with respect to Big Eight product differentiation in the small-client segment of the U.S. audit market. The evidence from this sample strongly supports the existence of a Big Eight price premium with respect to both second-tier national auditors and local/regional auditors. This is the first study to clarify that the Big Eight premium exists with respect to both subgroups of non-Big Eight auditors.

Given the assumption of competition in the small auditee market segment, higher Big Eight prices imply Big Eight product differentiation. This finding is consistent with Palmrose's [1986] study of the U.S. market, with studies of the Australian market [Francis, 1984 and Francis and Stokes, 1986], and with a study of the British market [Taffler and Ramalinggam, 1982]. Using Simunic's [1980, Table 3] framework, the consistent finding across studies of a Big Eight price premium for small auditees, coupled with the absence of an observed price premium for large auditees, suggests an audit market in which there is Big Eight product differentiation and in which there are either Big Eight scale economies for large auditees or diseconomies of scale for the non-Big Eight in the audits of large auditees.[10]

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[8] Previous studies of the U.S. audit market have found no significant relationship between audit fees and auditor tenure [Simunic, 1980]. However, Simunic did not treat initial audit engagements as a special case; rather, auditor tenure was coded for years on the engagement ranging from one (the special case studied here) to many years. In view of the increasing frequency of alleged price-cutting we also felt that using more recent data might yield different results.

[9] The only empirical study we know of that examines price cutting and audit quality is Palmrose [1985]. She considered the effect of fixed-fee versus cost-reimbursement contracting on both fees and hours worked per audit. Fixed-fee contracts were more associated with fewer years of auditor tenure including initial engagements, thus making it possible to low-ball or price-cut on such engagements (compared with cost-reimbursement contracting). But the interesting finding is that while audit fees were significantly lower for fixed-fee contracts (consistent with the low-balling/price-cutting hypothesis) there was no significant effect on audit hours. This latter finding is consistent with DeAngelo's [1981] argument that low-balling is neutral with respect to audit quality (to the extent that hours worked on an audit proxies for audit quality).

The results also suggest a reason for the contradictory findings of Simunic [1980] and Palmrose [1986] in the U.S. audit market. Auditee size is comparable between this study and Palmrose's (mean assets of $30–$40 million) compared with somewhat larger firms in Simunic's (mean assets of $177 million). A Big Eight price premium is evidenced in both this study and Palmrose's but not in Simunic's. It could be that the Big Eight premium was not observed in Simunic's study due to the presence of some larger firms in the sample. Francis and Stokes [1986] demonstrate that the ability to observe a Big Eight price premium may be sensitive to the definition of auditee size. Specifically, Francis and Stokes observed Big Eight premiums for very small auditees (mean assets of $1.8 million Australian) as did Francis [1984] for somewhat larger auditees (mean assets of $49 million Australian), but Francis and Stokes [1986] did not observe a Big Eight price premium for the very largest auditees (mean assets of $603 million Australian). Similar size sensitivity in the U.S. audit market might explain the different results obtained here and by Palmrose as compared with Simunic.

Finally, a side issue was addressed in the study with respect to price-cutting of initial audit engagements. The tests indicate that initial audits are priced significantly lower than are continuing engagements. This evidence should be treated cautiously, however, since only 12 of 220 observations represented initial engagements. In addition, the analysis only determines the possible existence of price-cutting behavior for initial engagements. No inferences are made with respect to the effect of price-cutting on audit quality.

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[10] Simunic's framework characterizes the absence of an observed Big Eight price premium for large auditees as diseconomies of scale for non-Big Eight firms in the audits of large clients. However, as Francis and Stokes [1986] point out, if there are two distinct market segments (large and small clients) involving distinctly different production functions, then one could appropriately infer Big Eight scale economies in the large-client segment of the market from the evidence on audit prices.

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Associations Between Forecast Errors and Excess Returns Near to Earnings Announcements

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ABSTRACT: This paper reassesses the information content of annual earnings announcements using errors in analyst forecasts published within one week of those announcements as the proxy for unexpected earnings. In addition to the use of analyst forecasts near to the announcement date, features which distinguish this study from earlier work include: a more precise dating of earnings announcements; a comparison of analyst forecast errors and changes in fourth-quarter earnings as proxies for unexpected earnings; tests of unusual variability in excess returns at the time of earnings announcements with the influence of forecast errors removed; a separation of early and late disclosers within an industry; and an examination of the properties of forecast range as an *ex ante* measure of earnings predictability.

We conclude that: provided that analyst forecast errors measure unexpected earnings, annual earnings announcements have information content even when compared to market expectations very near to those announcements; analyst forecast errors do not dominate fourth-quarter changes as a proxy for unexpected earnings; other information released concurrently with earnings announcements appears to have significant pricing implications; there is greater information content in earnings announcements of early disclosers than of late disclosers; and forecast ranges may provide a reasonable measure of the error in analyst forecasts, and hence of earnings predictability.

PRIOR research on the information content of earnings has found evidence of associations between various proxies for unexpected earnings and excess returns (e.g., Beaver, Clark, and Wright [1979], Fried and Givoly [1982]). The evidence supports the hypotheses that earnings announcements possess information content and that analyst forecasts outperform mechanical forecasts in the sense that associations between errors in *year-ahead* forecasts and cumulative abnormal returns over the 12 months preceding earnings announcements are stronger for the former than for the latter. More recently, Hagerman, Zmijewski, and Shah [1984] found that errors in mechanical forecasts (in particular, changes in fourth-quarter earnings) are significantly correlated

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with excess returns measured within a few days of earnings announcements.

The purpose of this paper is to reassess the information content of annual earnings announcements using errors in analyst forecasts published within one week of those announcements as the proxy for unexpected earnings. An earnings announcement is said to have information content if it induces a price reaction at the time of its release. Similar to Morse [1981], we define the relevant period for purposes of measuring price reactions as the two trading days commencing with the trading day on which the announcement is made. Our principal tests for a price reaction include tests of association between forecast errors and excess returns and tests of variability in announcement period excess returns.

In addition to the use of analyst forecasts near to the announcement date, features which distinguish this study from earlier work include: a more precise dating of earnings announcements by reference to the Broad Tape for the exact time of disclosure; a comparison of analyst forecast errors and changes in fourth-quarter earnings as proxies for unexpected earnings; tests of unusual variability in excess returns at the time of earnings announcements with the influence of forecast errors removed; a separation of early and late disclosers within an industry for detection of differential information content; and an examination of the properties of forecast range as an *ex ante* measure of earnings predictability.

Basically our findings are as follows: analyst forecast errors are significantly associated with excess returns despite the narrow window of time between those forecasts and earnings announcements; fourth-quarter changes appear to bear at least as strong an association with excess returns as analyst forecast errors; unusually large variations in excess returns at the time of earnings announcements persist even when the effects of forecast errors are removed; early disclosers tend to have smaller (absolute) forecast errors and greater variability in excess returns than late disclosers; and forecast ranges tend to be significantly associated with (absolute) forecast errors.

As discussed more fully later on, we conclude from these results that: conditional on the assumption that analyst forecast errors measure unexpected earnings, annual earnings announcements have information content even when compared to market expectations very near to those announcements; analyst forecast errors do not dominate fourth-quarter changes as a proxy for unexpected earnings; conditional on the assumption that a linear combination of analyst forecast errors and fourth-quarter changes removes the influence of unexpected earnings from announcement period excess returns, other information released concurrently with earnings announcements appears to have significant pricing implications; there is greater information content in earnings announcements of early disclosers than of late disclosers; and forecast ranges may provide a reasonable measure of the error in analyst forecasts, and hence of earnings predictability.

The remainder of this paper is organized as follows: the next section delineates our sampling procedures, test statistics, and other elements of our research design; the following section presents our findings on associations using analyst forecasts, comparisons involving mechanical forecasts, and variability of excess returns conditional on forecast errors; the next section presents our findings on intra-industry information transfers and forecast ranges; and the last section concludes the paper.

RESEARCH DESIGN

Forecasts of earnings per share (EPS) by Standard and Poor's (S&P) for the years 1979–81 were gathered on all calendar-year firms appearing in the subsequent mid-January issues of Standard and Poor's *Earnings Forecaster.*[1] Given the high concentration of firms reporting on a calendar-year basis, this restriction along with the replication over three successive years allowed us to reduce data-gathering costs without undue sacrifice in the number of sample observations. Additional requirements for a firm-year observation to be included in our sample were that a forecast be available from S&P (as opposed to forecasts from other services also reported in the *Earnings Forecaster*)[2] in the week preceding the firm's earnings announcement; that S&P's forecast take the form of a point estimate greater than zero;[3] that actual EPS be available on COMPUSTAT; that an earnings announcement be obtainable from the Broad Tape via the Dow Jones News Retrieval Service; and that a complete set of daily excess returns over 120 days centered on the preliminary earnings announcement date be available on CRSP.[4] The result is a sample comprised of 677 firm-year observations spread fairly evenly over the three years.[5]

Earnings announcements are dated from the Broad Tape rather than the *Wall Street Journal* (*WSJ*) to achieve greater precision in the measurement of excess returns potentially induced by those announcements. The Broad Tape runs from 8 a.m. to 6 p.m., whereas trading on the exchanges is limited to 10 a.m. through 4 p.m. This implies that investors cannot act until the next trading day on announcements made after 4 p.m. Hence, it is reasonable to align such announcements with excess returns on the following day.[6] In our sample, post-4 p.m. announcers comprise 11 percent of the total (i.e., 72 observations). A separate analysis of just those announcements indicates significantly greater price reactions on the trading day following their appearance on the Broad Tape, than on the Broad Tape date.

A complication in achieving consistency between forecasts and actual EPS is that S&P's classification of items as extraordinary (EI), or as relating to discontinued operations (DO), does not always agree with the accounting classifications of those items reflected on COMPUSTAT.[7] Accordingly, we also considered sampling rules under which observations involving EI and/or DO were either deleted, or deleted if their absolute sum exceeded five percent of EPS (568 and 612 observations, respectively). Similarly, given the high likelihood of errors in the variables when absolute forecast errors are large, we tried yet another rule, dropping those observations with a forecast error greater than 50 percent (659 observations). We performed parametric and nonparametric tests of association for each of these samples, with the result that the latter are quite robust across different sampling rules (more so than the parametric tests).[8] Accordingly, the full sample of 677 observations was employed in most of the analysis that follows.[9]

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[1] The Earnings Forecaster includes a bi-weekly master list and a weekly list of revisions of previous forecasts. While we use the most recent forecast or revision, these forecasts have not necessarily been revised (or reviewed) within one week of the earnings announcements.

[2] The composition of services providing forecasts varies across sample firms with S&P's forecast often the only one available. A difficulty with using average forecasts is that their statistical properties depend on the number of services included.

[3] Since we later scale forecast errors by forecasts, this restriction rules out negative denominators.

[4] Specifically, we refer to the CRSP daily excess returns file based on a beta-matching approach. A firm's excess return on a given day is defined as the difference between its actual return and an expected return computed on a reference portfolio of similar risk securities. All NYSE and AMEX stocks are placed into one of ten portfolios based on their estimated systematic risk (beta). A firm's expected return is the equal-weighted average return for the portfolio in which the firm has been placed. The beta (risk) values are computed using the methods described in Scholes and Williams [1977]. Recent evidence by Dyckman, Philbrick, and Stephan [1984] suggests that analyses of daily returns are quite robust with respect to alternative specifications to remove economy-wide effects.

[5] Sample sizes vary by year due to the restrictions imposed. The number of observations by year are 242, 192, and 243 for years 1979, 1980, and 1981, respectively. The smaller number of observations for 1980 is due to a week of missing data from the Broad Tape in February of the following year.

[6] Alternatively, we could have used either the earnings announcement date from COMPUSTAT, or the date the announcements appear in the *WSJ Index*. The former corresponds to the *WSJ Index* date in only 75 percent of the cases. While the latter is the next trading day after announcement on the Broad Tape in 98 percent of the cases, the *WSJ* does not indicate the time of disclosure. For our sample, aligning on the basis of the *WSJ* date would result in misaligning about 13 percent of the sample observations.

In the absence of theory to establish a well-defined relationship between forecast errors and excess returns, it is natural to be concerned with the properties of the test statistics used to assess that relationship. We seek a test of association that places the weakest possible demands on the data in terms of both the relationship between the variables of interest and the distributions of those variables, without sacrificing any greater statistical power than is necessary. This issue is particularly relevant in this study due to the prevalence of outliers.[10] A common parametric measure of association in studies of this sort is the Pearson-Product Moment (PPM) correlation coefficient (e.g., Fried and Givoly [1982]), which is appropriate in the bivariate normal case. Given that our data are nonnormal, the measure we employ as an alternative to the PPM coefficient is the Spearman Rank Order (SRO) correlation coefficient based on the ranks of the variables (e.g., Beaver, Clarke, and Wright [1979]).[11] For tests of variation in absolute standardized

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[7] Upon reviewing the data we discovered an obvious and large misclassification pertaining to U.S. Steel. S&P forecasted about a $300 million profit in 1979. Because of a $600 million (after-tax) charge, U.S. Steel reported a loss of about $300 million. The writeoffs were announced in November 1979, and it seems likely that S&P treated these items as extraordinary, thus excluding them from their forecast even though they were not reported as extraordinary items by U.S. Steel. The computed S&P forecast error would have been a large negative value (about 200 percent) even though a *WSJ* article indicated that the large loss was expected by analysts. Including this observation in the sample without adjustment would have produced a negative coefficient on the forecast error variable. Rather than delete this observation, we elected to compute the forecast error using earnings before the large writeoff, thus producing a forecast error near zero. The results with this observation deleted were very similar to those reported.

[8] See Appendix, Table A1, for results of tests (parametric and nonparametric) on associations between forecast errors and excess returns under various sampling rules. The parametric correlations are relatively sensitive to sample deletion rules by comparison to the nonparametric correlations.

[9] Only for tests involving the joint effects of analyst forecast errors and fourth-quarter changes do we resort to parametric analysis, specifically multiple regressions. While we would prefer to employ nonparametric methods here as well, we were unable to identify a multivariate nonparametric analog. Truncation rules are used to assess sensitivity to outliers when multiple regression is employed.

[10] Using the full sample of 677 observations, we performed a test of normality both for forecast errors and for excess returns. For every configuration of forecast errors and each set of excess returns (i.e., announcement day, next day, and two-day combined), we are able to reject the hypothesis that the distributions from which sample observations are drawn are normal. With respect to forecast errors, sample distributions tend to be fatter-tailed and more peaked than is true for the normal distribution, implying that outliers could play an important role in tests based on parametric statistics. Specifically, we employ a Kolmogorov-Smirnov test, the "D" statistic from which was significant in all instances at better than the one-percent level.

[11] The Pittman efficiency of tests based on the SRO coefficient, relative to the PPM coefficient, is .912 (see Lehmann [1975], p. 316). This means that even when the assumption of bivariate normality is met, in the limit as sample sizes tend toward infinity, a t-test constructed on the PPM coefficient requires 91.2 percent of the sample size of a t-test constructed on the SRO coefficient for a given confidence level. Hence, the statistical power lost under conditions most suitable to a test based on a parametric measure of association, by resorting to a nonparametric measure is quite small. See Kendall and Stuart [1961] for further details on the derivation and properties of this efficiency metric.

TABLE 1

NONPARAMETRIC CORRELATIONS OF ANALYST FORECAST ERRORS AND EXCESS RETURNS

Time Period	*Spearman Rank Order Correlation*		
	Trading Day(s)		
	First	*Second*	*Combined*
Announcement Period			
Estimate	.1852	.0962	.2378
Prob. > |t|	.0001	.0123	.0001
Rank[a]	1	5	1

	Number of Days Before Announcement				
	One	*Two*	*Three*	*Four*	*Five*
Pre-announcement Period					
Daily Excess Returns					
Estimate	−.0647	.1065	.1035	.0177	.0437
Prob. > |t|	.0925	.0059	.0071	.6461	.2566
Cumulative Excess Returns					
Estimate	−.0647	.0395	.0831	.0919	.0947
Prob. > |t|	.0925	.3046	.0306	.0168	.0137

	Number of Days After Announcement				
	One	*Two*	*Three*	*Four*	*Five*
Post-announcement Period					
Daily Excess Returns					
Estimate	.0232	−.0754	−.0364	.0192	.0756
Prob. > |t|	.5468	.0500	.3441	.6183	.0494
Cumulative Excess Returns					
Estimate	.0232	−.0389	−.0407	−.0185	.0086
Prob. > |t|	.5468	.3127	.2904	.6315	.8240

[a] "Rank" refers to the ranking of the indicated correlation coefficient out of the surrounding 120-day (59 two-day) periods.

excess returns, we rely principally on tests patterned after Morse [1981].

PRINCIPAL FINDINGS

Tests of Association

Table 1 reports Spearman Rank Order (SRO) correlations between analyst forecast errors (i.e., [actual-forecast]/forecast)[12] and excess returns on the two trading days beginning with the date of earnings announcements on the Broad Tape.

All correlations for the two-day "announcement period" are positive and highly significant. The estimated coefficient for the first trading day is the largest over the entire surrounding 120-day sampling period, while that for the second day is fifth largest.

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[12] We also scaled forecast errors by share prices (the thought being to obtain a measure analogous to excess returns [Christie, 1985]) and employed unscaled forecast errors. As shown in Table A1, the nonparametric correlations are quite robust across scaling alternatives, while the parametric correlations are less so.

Given that analyst forecast errors proxy well for unexpected earnings at the time of earnings announcements, we interpret the results as evidence in support of a hypothesis of information content for those announcements. We view this result as an extension of Fried and Givoly [1982] in the sense that information content is assessed relative to unexpected earnings measured over a far shorter interval than the time span of a year employed in their study. If, alternatively, we assume an information content to earnings announcements, then the low magnitude of the estimated correlation coefficients suggests either that analyst forecast errors are not close proxies for unexpected earnings and/or that other information beyond earnings *per se* is reaching the market at (or about) the same time.

Correlations are also estimated using both daily and cumulative daily returns over five-day pre- and post-announcement periods. Coefficients for pre-announcement days two and three, and days three through five cumulatively, are significant at better than the five-percent level, implying some anticipation or "leakage" of earnings announcements caused by a delay in reporting "bad news" (see Chambers and Penman [1984]), or an intra-industry information transfer (see Foster [1981]). However, there is no evidence of persistence in market reactions beyond the (two-day) announcement period.

One way to reduce the effects of unsystematic errors in our proxy for unexpected earnings, or the effect of other firm-specific disclosures, is to form portfolios of sample observations prior to performing the cross-sectional analysis. Accordingly, we extended the correlational analysis by forming 27 small portfolios, each containing 25 (or 26) firm-year observations, based on ranked forecast errors, and repeating the correlations using portfolio median forecast errors and portfolio mean excess returns. The results are presented in Table 2. Correlations on the two trading days comprising the announcement period are, again, highly significant. The larger size of the coefficients corresponds to the finding of Beaver et al. [1979] and can be attributed to the expected effects of aggregation.[13] As before, we note strong evidence of anticipation of forecast errors over the five days preceding the announcement and no evidence of persistence beyond the announcement period.

Forecast Error Comparisons

In light of the results reported by Hagerman et al. [1984], we replicated our tests of association substituting mechanical forecast errors (i.e., fourth-quarter changes) for analyst forecast errors.[14] Table 3 provides a comparison of the announcement period results reported above and the results from the replication at both an individual firm-year observation level and at the same

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[13] As mentioned above, forming portfolios tends to eliminate the effects of other firm-specific disclosures. Later we will be interested in the extent to which such disclosures are present.

[14] Following Hagerman et al. [1984], we define fourth-quarter forecast errors as [current year fourth-quarter earnings minus prior year fourth-quarter earnings]/absolute value of prior year fourth-quarter earnings. We also performed the analysis scaling mechanical fourth-quarter forecast errors by analyst (annual) forecasts, or scaling annual analyst forecast errors by fourth-quarter forecasts. In addition, as with analyst forecast errors, we scaled mechanical fourth-quarter forecast errors by share prices. For all cases, the results were essentially the same as those reported, implying that the scaling selection is not important.

TABLE 2

NONPARAMETRIC CORRELATIONS BETWEEN (SMALL) PORTFOLIO MEDIAN ANALYST FORECAST ERRORS AND (SMALL) PORTFOLIO EXCESS RETURNS:[a] PORTFOLIOS FORMED BASED ON ANALYST FORECAST ERRORS

Time Period		*Spearman Rank Order Correlation*			
		Trading Day(s)			
		First	*Second*	*Combined*	
Announcement Period					
Estimate		.7167	.5452	.8016	
Prob. > $\|t\|$		.0001	.0033	.0001	
		Number of Days Before Announcement			
	One	*Two*	*Three*	*Four*	*Five*
Pre-announcement Period					
Daily Excess Returns					
Estimate	−.2314	.4408	.5134	.2668	.0604
Prob. > $\|t\|$	.2455	.0214	.0062	.1786	.7646
Cumulative Excess Returns					
Estimate	−.2314	.1447	.4090	.4151	.4029
Prob. > $\|t\|$	.2455	.4715	.0341	.0313	.0372
		Number of Days After Announcement			
	One	*Two*	*Three*	*Four*	*Five*
Post-announcement Period					
Daily Excess Returns					
Estimate	.1563	−.3437	−.0342	.0867	.2802
Prob. > $\|t\|$	.4363	.0792	.8656	.6672	.1569
Cumulative Excess Returns					
Estimate	.1563	−.0757	−.2204	−.0916	.0250
Prob. > $\|t\|$	.4363	.7074	.2693	.6496	.9014

[a] Twenty-seven portfolios of 25 (or 26) firm-year observations each.

small portfolio level as before. Surprisingly, the associations between forecast errors and excess returns are slightly stronger using mechanical forecasts than they are using analyst forecasts at an individual firm-year observation level (although very similar at a small portfolio level).

Inasmuch as analysts have the benefit of revising their fourth-quarter estimates to give effect to information derived from the first three quarters, we would expect the ordering of correlations to be the reverse of that shown. One possible explanation for the higher level of association using mechanical fourth-quarter forecasts is the prominence of the (percentage) change in fourth-quarter EPS on the Broad Tape. Fourth-quarter results generally precede annual

TABLE 3

COMPARISONS OF NONPARAMETRIC CORRELATIONS USING MECHANICAL (FOURTH-QUARTER) FORECAST ERRORS AND EXCESS RETURNS WITH THOSE USING ANALYST (ANNUAL) FORECAST ERRORS

	Spearman Rank Order Correlations		
	Trading Day(s)		
Forecast Model	*First*	*Second*	*Combined*
Individual Firm-Year Level			
Mechanical (Fourth-Quarter) Forecasts			
Estimate	.2546	.1448	.3026
Prob. > |t|	.0001	.0002	.0001
Analyst (Annual) Forecasts			
Estimate	.1852	.0962	.2378
Prob. > |t|	.0001	.0123	.0001
Small Portfolio Level			
Mechanical (Fourth-Quarter) Forecasts			
Estimate	.7430	.7210	.8046
Prob. > |t|	.0001	.0001	.0001
Analyst (Annual) Forecasts			
Estimate	.7167	.5452	.8016
Prob. > |t|	.0001	.0033	.0001

results and other disclosures made within the content of earnings announcements appearing on that medium. Another factor that bears consideration is that analyst forecasts need not have been revised near to when they were published. Still, the result is somewhat anomalous.

Given that mechanical forecast errors appear to contain as much information as analyst forecast errors, it is interesting to compare the accuracy of forecasts. Having rescaled analyst forecast errors in the same manner as mechanical fourth-quarter errors, we obtain a median absolute forecast error of .1315 which is significantly lower than the .2159 for mechanical forecasts (at better than the one-percent level).[15] In general, we might expect analyst forecasts to be more accurate.[16] However, it also seems likely that more accurate forecasts would result in forecast errors that are more highly associated with excess returns, an expectation that runs counter to the above findings.[17]

We next consider a multivariate analysis to determine the extent to which the mechanical forecast errors capture different information than analyst forecast errors. Multiple regression analysis was used in the absence of a suitable non-

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[15] Wilcoxon signed-rank test was employed.

[16] See Brown and Rozeff [1978] and Imhoff and Pare [1982].

[17] Similar to our results, O'Brien [1986] also finds lower associations between analyst forecast errors and excess returns than between mechanical forecast errors and excess returns.

TABLE 4

MULTIVARIATE REGRESSION ANALYSIS OF TWO-DAY EXCESS RETURNS ON ANALYST FORECAST ERRORS AND MECHANICAL FORECAST ERRORS

	Regression Test Results		
Sampling Rule	*Analyst Forecast Errors*	*Mechanical Forecast Errors*	*Adjusted R^2*
All 677 firm-year observations			.0243
t-Value	2.446	3.428	
prob. > $\|t\|$	.0147	.0006	
668 firm-year observations (dropping five largest $\|$forecast errors$\|$ of both types)			.0594
t-Value	3.805	3.662	
Prob. > $\|t\|$	.0002	.0003	
659 firm-year observations (dropping ten largest $\|$forecast errors$\|$ of both types)			.0639
t-Value	3.373	3.740	
Prob. > $\|t\|$	.0008	.0002	

parametric method, with various sampling rules used as sensitivity tests for outliers. The models used in this analysis include regressions with the two forecast errors included as explanatory variables, using the full sample and two sampling rules for deleting outliers. The results for the two-day announcement period are reported in Table 4.

It is evident that the errors in both forecast models are significantly associated with announcement period excess returns for all three sampling rules. These results imply a positive marginal contribution for each of the two types of forecast errors. As with the parametric correlations reported in Appendix Table A1, the explanatory power of the multiple regressions increases with the elimination of outliers, though in all cases it is quite low.

At least two explanations are possible for the joint significance of two proxies for unexpected earnings. As shown by Brown et al. [1985], this finding is consistent with the econometric problem of errors in the variables. That is, given that the noise in forecast errors is uncorrelated with the excess returns, significant positive coefficients on the two proxies suggest that both measure unexpected earnings with error. The competing explanation is that neither proxy is free of the influence of the other factors which may also affect excess returns. Just what those factors might be is something that could conceivably be identified from research on the determinants of forecast errors. However, such an investigation is beyond the scope of the analysis in this study.[18]

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[18] See Brown, Richardson, and Schwager [1985] for recent research on this issue.

Tests of Variation

Given the low explanatory power of forecast errors (computed either way) and the presence of other disclosures made concurrently with earnings announcements, we examine whether unusual price variability is present after removing the effects of those errors. The low adjusted R-squared values from Table 4 suggest only that there is still considerable unexplained variation in excess returns even when the influence of proxies for unexpected earnings has been removed. However, it remains to be determined if the unusual price variation on earnings announcement dates is entirely attributable to those announcements *per se*.[19]

To address this issue, we replicated Morse's nonparametric tests for distributions of excess returns corresponding to three large portfolios formed on a basis of ranked absolute forecast errors using both analyst forecasts and mechanical forecasts. Specifically, we used non-announcement period returns to estimate prior probabilities that absolute excess returns greater than two standard deviations would occur during the announcement period.[20] These estimates, together with the frequencies observed during the announcement period, were used to construct the binomial tests shown in Table 5.

It is evident from the table that observed frequencies are significant on both trading days for all three portfolios under both forecasting models.[21] Although not reported in Table 5, we again extended the tests to several days before and after the announcement period. The observed frequency was significant for one portfolio on the day after the second trading day, but the others were insignificant.[22]

Note in particular the high frequency of unusually large price changes for the low absolute forecast error portfolio, whichever of the two forecast models is employed. None of the forecast errors in the low absolute forecast error portfolio exceeds two percent using analyst (annual) forecasts, or 13 percent using mechanical (fourth-quarter) forecasts.[23] Yet, in 21 cases for analyst forecasts and 24 cases for mechanical forecasts, announcement period excess returns exceed two standard deviations.[24] (The average frequency during non-announcement periods is approximately 12.)

Since the information contained in the two types of forecast errors is only partially redundant, it is appropriate to consider the joint influence of those errors by forming portfolios on a basis of the

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[19] It should be mentioned that this analysis is an extension of Morse [1981], in that we consider the extent to which the unusual variations in excess returns which he has documented can be attributed to the influence of the announcement of earnings *per se*.

[20] The choice of a cutoff value of two is, of course, arbitrary and is employed as a means of dichotomizing observations as required for applying a test based on a binomial distribution. Following Morse [1981], we also employed a cutoff value of one.

[21] The results using a cutoff value of one are significant on the first trading day and on the two days combined, but not on the second day. The lack of significance for the frequencies observed on the second trading day using a critical value of one implies that the larger excess returns on that day tend to be quite large.

[22] This result departs slightly from Morse [1981], where significance was found for two days subsequent to the announcement period.

[23] The higher median error percentage for mechanical forecasts is partly because errors in those forecasts are scaled by just the fourth-quarter forecast rather than the annual forecast as with analyst forecast errors, and partly because of the relatively greater inaccuracy of the mechanical model.

[24] One possible explanation for the unusually large price changes when analyst forecasts are small is that the S&P forecast may be a poor proxy for the market's consensus. To investigate this, we computed a forecast error using the average forecast of all other services included in the S&P Earnings Forecaster (omitting S&P's own forecast). In only three (of 21) cases is the consensus forecast error greater than five percent, and in just one of those three is the sign of the forecast error the same as that of the excess return.

TABLE 5

NONPARAMETRIC TESTS ON DISTRIBUTIONS OF WITHIN-(LARGE) PORTFOLIO ABSOLUTE STANDARDIZED EXCESS RETURNS DURING ANNOUNCEMENT PERIOD: PORTFOLIOS FORMED ON A BASIS OF RANKED ABSOLUTE FORECAST ERRORS

Forecast Model				*Binomial Frequencies*[a] *and Test Results*		
				Trading Day(s)		
Portfolio Number	*Number of Firms*	*Median Absolute Forecast Error*		*First*	*Second*	*Combined*
Analyst (Annual) Forecasts						
1	225	.0064	Expected Frequency	11.7	11.7	11.9
			Observed Frequency	21	18	21
			t-Value	2.792*	1.891*	2.700*
2	226	.0302	Expected Frequency	11.7	11.7	12.0
			Observed Frequency	27	22	27
			t-Value	4.568*	3.070*	4.460*
3	226	.1132	Expected Frequency	11.7	11.7	12.0
			Observed Frequency	32	19	29
			t-Value	6.066*	2.171*	5.052*
Mechanical (Fourth-Quarter) Forecasts						
1	225	.0636	Expected Frequency	11.7	11.7	11.9
			Observed Frequency	27	16	24
			t-Value	4.581*	1.208	3.582*
1	226	.2159	Expected Frequency	11.7	11.7	12.0
			Observed Frequency	23	23	24
			t-Value	3.383*	3.383*	3.567*
3	226	.7095	Expected Frequency	11.7	11.7	12.0
			Observed Frequency	30	20	29
			t-Value	4.564*	2.470*	5.052*
Joint Forecasts[b]						
1	225	N/A	Expected Frequency	11.7	11.7	11.9
			Observed Frequency	27	14	20
			t-Value	4.581*	.614	2.395*
2	226	N/A	Expected Frequency	11.7	11.7	12.0
			Observed Frequency	25	28	31
			t-Value	3.864*	4.865*	5.644*
3	226	N/A	Expected Frequency	11.7	11.7	12.0
			Observed Frequency	28	17	26
			t-Value	4.865*	1.572	4.160*

* Significant at the five percent level, one-sided.

[a] Frequencies refer to the number of times (expected or observed) absolute excess returns exceed two standard deviations.

[b] These portfolios consider the joint effects of the two forecast errors by first ranking their absolute values and then ranking the sum of these ranks. Portfolio 1 has the lowest sum of ranks and Portfolio 3 the highest.

magnitude of both. Simply summing the absolute forecast errors would cause the mechanical forecast errors to dominate the portfolio construction due to the fact that they are larger. Accordingly, we summed the ranks of absolute values and then ranked the summed values. Results on the binomial tests for these new port-

TABLE 6

NONPARAMETRIC TESTS ON DISTRIBUTIONS OF RESIDUAL STANDARDIZED EXCESS RETURNS DURING ANNOUNCEMENT PERIODS:
USING FULL SAMPLE AND SUBSAMPLES WITH LARGE FORECAST ERRORS DELETED

Returns Type			*Binomial Frequencies[b] and Test Results*		
			Trading Day(s)		
Sampling Rule	*Number of Firms*		*First*	*Second*	*Combined*
Residual Standardized Excess Returns[a]					
Full Sample	677	Expected Frequency	35.2	35.2	35.9
		Observed Frequency	76	58	79
		t-Value	7.083*	3.958*	7.405*
Deleting Five Largest (of Each Forecast Error)	668	Expected Frequency	34.7	34.7	35.4
		Observed Frequency	70	58	76
		t-Value	6.171*	4.073*	7.024*
Deleting Ten Largest (of Each Forecast Error)	659	Expected Frequency	34.3	34.3	34.9
		Observed Frequency	68	58	72
		t-Value	5.933*	4.173*	6.463*
(Full) Standardized Excess Returns					
Full Sample	677	Expected Frequency	35.2	35.2	35.9
		Observed Frequency	80	59	77
		t-Value	7.777*	4.132*	7.062*

* Significant at the five percent level, one-sided.

[a] Residuals from regressions of standardized excess returns on analyst forecast errors and mechanical fourth-quarter forecast errors.

[b] Frequencies refer to the number of times (expected or observed) absolute excess returns exceed two standard deviations.

folios are presented in the third panel of Table 5. For the two days combined, we again find significance for each of the three portfolios.

In keeping with the earlier extension to an analysis of joint information content (reported in Table 4), we also applied the binomial tests to the residual standardized excess returns resulting from the multiple regression in which both forecast errors appeared as explanatory variables. In addition to using the full sample, we again employed two rules for deleting outliers (five largest of each forecast error, and ten largest of each). As shown in Table 6, we compared the results of these binomial tests with tests applied to standardized excess returns before removing the influence of forecast errors.

Consistent with the low R-squared values reported in Table 4 and the within-(large) portfolio tests reported in Table 5, the degree of unusual price variation beyond that occurring in non-announcement periods, and beyond that attributed to the forecast errors, is highly significant. Indeed, the observed frequencies of outliers using residual absolute standardized excess returns are not much different from those when "full" absolute standardized excess returns are used.[25] The implication of these results is

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[25] In one case there are actually fewer outliers before extracting the influence of forecast errors.

TABLE 7

NONPARAMETRIC ANALYSIS OF EARLY DISCLOSERS VS. LATE DISCLOSERS WITHIN INDUSTRIES

	Spearman Rank Order Correlations	
	Analyst Forecast Errors	*Mechanical Forecast Errors*
Tests of Association Between Forecast Errors and (Two-day) Combined Excess Returns		
Early Disclosers (121 observations)		
Estimate	.2036	.3175
Prob. > $\|t\|$	(.0251)	(.0004)
Late Disclosers (126 observations)		
Estimate	.2713	.3116
Prob. > $\|t\|$	(.0021)	(.0004)
	Binomial Tests	
Tests of Within Subsample Variability of (Two-day) Combined Excess Returns		
Early Disclosers (121 observations)		
Expected Frequency	6.3	
Observed Frequency	15	
t-Value	3.57*	
Late Disclosers (126 observations)		
Expected Frequency	6.5	
Observed Frequency	10	
t-Value	1.40	
	Wilcoxon Rank Sums Test	
	Early Disclosers (121 obs.)	*Later Disclosers (126 obs.)*
Tests of Difference in Absolute Forecast Errors and Firm Size		
Median Absolute Analyst Forecast Errors	.0204	.0400
z-Value	−3.51	
Prob. > $\|z\|$	(.0005)	
Median Firm Size (Market Value in Millions)	1104	613
z-Value	4.06	
Prob. > $\|z\|$	(.0001)	

* Significant at the five percent level, one-sided.

that more information is released at the time of earnings announcements than is captured by our proxies for unexpected earnings.[26]

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[26] For the 21 firms with low analyst forecast errors and large excess returns, we examined all disclosures made on the Broad Tape and in the *WSJ* on the two trading days of the announcement period. In 19 out of 21 cases we found additional disclosures beyond the announcement

FURTHER ANALYSIS

Intra-Industry Information Transfers

As suggested by Foster [1981], the information content of earnings announcements may vary across firms in the same industry due to information transfers between early and late disclosers. *Ceteris paribus,* we might expect greater excess returns variability for early disclosers than for late disclosers, though not necessarily higher associations between forecast errors and excess returns. To assess such differences between early disclosers and late disclosers, we classified our sample by four-digit SIC code. Excluded were industries for which our sample contained only one firm. Early disclosers were defined as the first discloser, and late disclosers were defined as the last discloser, with a minimum of five trading days separating the two.[27] Table 7 presents the results of our analysis.

From Table 7 we observe an approximately similar set of significant nonparametric correlation coëfficients between forecast errors and (two-day) combined excess returns as that shown in Table 3. Given that forecasts could have been updated subsequent to earnings announcements by early disclosers, there is no reason to expect otherwise. However, consistent with the information transfer effect hypothesized by Foster, we find greater variability in excess returns during the announcement period for early disclosers than for late disclosers. This is particularly noteworthy in light of the remaining results that early disclosers tend to be larger and to have smaller absolute forecast errors. Thus, there is a strong information transfer effect embedded within our earlier results for the sample as a whole.[28]

Ex Ante Earnings Predictability

Finally, in the spirit of Pincus [1983], we sought to determine if the unusual variations in excess returns at the time earnings are announced are reflected in greater *ex ante* uncertainty, which we measure in the form of the range in analyst forecasts. Because by definition forecast range is increasing in the number of forecasts, we first categorized sample observations by the number of forecasting services. Dropping 124 observations for which there was but one forecast, we divided the subsamples within each number of forecasting services into high (above median) and low (below median) forecast ranges. These high and low subsamples were then pooled across number of services categories. Our tests are defined between these pooled observations.[29] The results appear in Table 8.

The viability of forecast range as an *ex ante* measure of earnings predictability is

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of earnings *per se.* These disclosures included three changes in dividends, eight restatements of prior year's income, four accounting changes, four discussions of future capital spending, four forecasts of future earnings performance, nine discussions of current earnings performance, and seven announcements of other types. Thus it is evident that more could be influencing prices during the announcement period than forecast errors alone.

[27] We also employed a rule wherein early disclosers were the first discloser plus others disclosing within five trading days, and later disclosers were defined as all firms disclosing more than five trading days after the first. The results were fairly similar to those subsequently reported.

[28] The results are also consistent with Chambers and Penman [1984], who found that late disclosers are more likely to make "bad news" announcements that were anticipated by the market.

[29] In addition to the tests reported, we determined median values of forecast range, absolute forecast errors, firm size by number of forecasting services, and nonparametric correlations between forecast ranges and absolute forecast errors within each "number of services" category. These results are reported in Appendix Table A2.

TABLE 8

NONPARAMETRIC ANALYSIS OF FORECAST RANGE AND EARNINGS PREDICTABILITY

	Wilcoxon Rank Sums Tests	
	Low Forecast Range (277 observations)	*High Forecast Range (276 observations)*
Median Absolute Analyst Forecast Errors	.0200	.0427
z-Value	−6.627	
Prob. > |z|	(.0001)	
Median Absolute (Two-day) Combined Excess Returns	.0150	.0181
z-Value		−1.5694
Prob. > |z|	(.1165)	
Median Firm Size (Market Value in Millions)	1,066	945
z-Value	2.6276	
Prob. > |z|	(.0086)	

supported by the finding of a significantly greater median absolute forecast error for the high-range group than for the low-range group. The evidence also suggests that firms with high forecast ranges tend to have larger absolute excess returns than those with low forecast ranges, although the difference in median values is not significant at conventional levels. On the other hand, because the median firm size is lower for the high-forecast range group than for the low-forecast range group, it is possible that this difference in absolute excess returns is attributable to firm size.

CONCLUSION

The principal findings of this study are as follows:

(1) There is significant information content to annual earnings announcements even when measured by associations between excess returns and errors in analyst forecasts published within one week of those announcements. Surprisingly, these associations are no stronger than those obtained when the same excess returns are correlated with fourth-quarter changes in earnings. Although we do not have a theoretical explanation for this finding, it should be noted that the analyst forecasts employed need not have been revised near to the time they were published and that fourth-quarter changes are prominently displayed on the Broad Tape and in the *WSJ*.

(2) A considerable portion of the greater than usual variability in excess returns at the time of earnings announcements remains unexplained after removing the effects of analyst forecast errors and fourth-quarter changes. Inspection of the Broad Tape supports the conjecture that much more than just the earnings number is often concurrently disclosed.

(3) Early disclosers of earnings within an industry display greater variability in excess returns near to those announcements than late disclosers. Moreover, despite the fact that absolute forecast errors are greater for the late disclosers, the variability in excess returns for those disclosers is not significantly greater than

Table A1

Sensitivity of Parametric and Nonparametric Correlations Between Analyst Forecast Errors and Excess Returns During the Announcement Period Under Different Sampling Rules and Scaling Alternatives

Sampling Rule		Spearman Rank Order (SRO) Correlation			Pearson Product Moment (PPM) Correlation		
		Trading Days			Trading Days		
Announcement Period		*First*	*Second*	*Combined*	*First*	*Second*	*Combined*
677 firm-year observations (with post-4 P.M. announcements dated the next trading day)	Estimate	.1852	.0962	.2378	.0731	.0751	.1009
	Prob. > $\|t\|$	.0001	.0123	.0001	.0573	.0507	.0086
568 firm-year observations (with those containing Extraordinary Items (EI) and Discontinued Operations (DO) deleted)	Estimate	.1975	.0990	.2512	.1234	.0900	.1473
	Prob. > $\|t\|$	.0001	.0183	.0001	.0032	.0320	.0004
612 firm-year observations (with those containing $\|$EI plus DO$\|$ >.05 deleted)	Estimate	.1951	.0943	.2434	.1264	.0828	.1449
	Prob. > $\|t\|$	.0001	.0197	.0001	.0017	.0406	.0003
659 firm-year observations (with those containing $\|$forecast errors$\|$ >.50 deleted)	Estimate	.1908	.0928	.2447	.2132	.1111	.2238
	Prob. > $\|t\|$	.0001	.0172	.0001	.0001	.0043	.0001
677 firm-year observations (with no distinction between pre- and post-4 P.M. announcements)	Estimate	.1709	.0882	.2304	.1020	.0616	.1083
	Prob. > $\|t\|$	.0001	.0217	.0001	.0079	.1090	.0048
677 firm-year observations (with forecast errors scaled by year-end market price)	Estimate	.1720	.0898	.2249	.0384	.0650	.0696
	Prob. > $\|t\|$	.0001	.0194	.0001	.3190	.0909	.0703
677 firm-year observations (with unscaled forecast errors)	Estimate	.1698	.0759	.2156	.0391	.0680	.0720
	Prob. > $\|t\|$	.0001	.0484	.0001	.3096	.0773	.0610

TABLE A2

CORRESPONDENCE BETWEEN THE NUMBER OF FORECASTING SERVICES, MARKET VALUES, ABSOLUTE FORECAST ERRORS, ABSOLUTE EXCESS RETURNS, AND PERCENTAGE FORECAST RANGE

Number of Forecasting Services	*Number of Firms*	*Median Market Values*[a]	*Median Absolute Forecast Errors*	*Median Percentage Forecast Range*	*Spearman Rank Order Correlation Between Percentage Forecast Range and Absolute Forecast Error*[b]
1	124	331	.0578	0	—
2	176	667	.0297	.0305	.2414 (.0012)
3	133	950	.0255	.0370	.3022 (.0004)
4	94	1251	.0235	.0528	.5460 (.0001)
5	74	1380	.0342	.0586	.3428 (.0028)
6	40	2307	.0258	.0684	.4613 (.0027)
7	22	2637	.0386	.0842	.1469 (.5142)
8	7	6139	.0257	.1026	.3571 (.4316)
9 or more	7	9826	.0166	.0947	−.7143 (.0713)

[a] In millions of dollars.

[b] Figures in parentheses are the significance levels of the correlations above.

during surrounding non-announcement periods.

(4) We note that forecast range provides an *ex ante* measure of earnings predictability. However, the greater absolute excess returns that tend to accompany high forecast ranges (when compared to low forecast ranges) might be explained by the smaller average firm size of the latter group.

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Cue Usage and Self-Insight of Financial Analysts

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ABSTRACT: An experiment was conducted where practicing financial analysts provided risk and return judgments on 30 equity securities. The ability of financial analysts to subjectively express the relative emphasis they place on the available cues when generating their judgment evaluations was assessed by three alternative measurement methods. The results indicate the analysts exhibited a relatively high degree of self-insight since their subjective indications of cue importance were consistent with the models and outputs of their judgment policies.

An important dimension of human decision making is an individual's ability to express the relative emphasis he or she places on information cues when generating judgments. This aspect of human judgment is known as self-insight, and it forms a distinct topic in the research literature. Self-insight is critical in judgment situations where a considerable degree of professional expertise is communicated verbally or "on the job" [Joyce, 1976]. Unless self-insight is adequate, a judge will communicate a distorted representation of his or her judgment model. Similarly, an absence of self-insight makes it difficult to correctly specify the information requirements of a particular judgment task.

A number of researchers have investigated self-insight within accounting and business contexts [Ashton, 1974; Joyce, 1976; Savich, 1977; Slovic, Fleissner, and Bauman, 1972; Wright, 1977, 1979]. Results indicate only limited self-insight although research findings differ across alternative measurement techniques, subject groups, and experimental (and field) conditions [Ashton, 1982; Wright, 1977]. Subjects frequently over- (under-) estimate the perceived importance of relatively minor (major) cues. In general, a small number of important cues account for a substantial portion of the variation in actual judgment evaluations.

The purpose of this study is to provide additional evidence on the self-insight ability of financial analysts. Following prior research we use the Brunswik lens model in a security prediction task. Research emphasis focuses on three alternative methods of measuring self-insight: the correlation between the objective and subjective weight indications of financial analysts, the ability of subjective weight models to reproduce actual judgments,

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and the correlation between the predicted outputs of the subjective weight model and the individual's optimal regression model.

RESEARCH METHOD

Subjects

Subjects were 38 professional security analysts, portfolio managers, and stockbrokers drawn from a wide variety of financial institutions throughout New Zealand. Their responses to a debriefing questionnaire indicated substantial variation in participant age, experience, educational qualification, and investment activity. Age ranged from 22 to 67 years with an average age of 31.4, and investment experience was one to 37 years with a mean of 7.4. Of the 38 subjects, 34 were male. There were 29 financial analysts and nine portfolio managers. Thirty-three subjects had a university education.

Experimental Instrument

The experimental instrument involved a standard application of the Brunswik lens model in a financial decision context. The specific judgment task involved a dual financial appraisal of (1) the expected risk and (2) the expected 12-month holding period return on an individual stock in a well-diversified portfolio.

Subjects were given nine company-specific cues and one instrumental industry variable. The nine variables were net assets, proprietorship ratio, liquid ratio, sales growth, dividend cover, profitability, valuation ratio (share price/net asset backing per share), systematic risk, and variance of returns.[1] Market-wide indicators and expected industry results were also provided to simulate a more realistic setting for the usage of the company-specific cues.

Subjects recorded their risk evaluations on a scale ranging from a score of one ("riskless") to a score of nine ("extremely risky"). Subjects recorded their expected return judgment in a box adjacent to the risk rating scale. Each subject evaluated 30 financial profiles.

Experimental Procedure

The experiment was administered in two separate and independent geographical locations. The first experiment was conducted at a conference organized by the New Zealand Society of Investment Analysts. The second was conducted in the boardroom of a prominent brokerage firm.[2] At the completion of the experiment, subjects allocated 100 points across the experimental cues according to the perceived relative importance of each cue in formulating the subject's risk and return judgments.[3] One subject failed to correctly complete the 100-point allocation exercise, so the results which follow are based on 37 responses.

RESULTS

Comparison of Objective and Subjective Weights

A common method of assessing judgmental self-insight compares the subjective weight indications obtained by the 100-point allocation method with the objective weights obtained from the multivariate regression of subject judgments

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[1] Considerable care and effort was taken in selecting this stimulus set. Interviews with financial analysts, surveys of stockbroker investment publications, and searches of the business and academic literature were made to create more realism in the experimental design. The final selection of stimuli was facilitated by an orthogonal factor analysis and pretested in a sample study.

[2] As far as we are aware, none of subjects in the second setting had prior knowledge of the experimental task. Subsequent analyses revealed no statistically significant differences between the two settings of the experiment.

[3] The robustness of this simple evaluation method in reproducing the cue weights obtained by more complex elicitation methods is well documented in the literature [Cook and Stewart, 1975].

TABLE 1

DISTRIBUTION OF WEIGHTS AND SELF-INSIGHT CORRELATIONS

A. Distribution of Subjective and Objective Weights

	Subjective Weight S	*Objective Weight O*	*Difference*
(*a*) *Risk Judgments:*			
Net Assets	6.26	9.10	−2.84
Proprietorship Ratio	13.42	17.09	−3.67
Liquidity	11.82	8.40	3.42
Sales Growth	8.73	5.20	3.53
Dividend Cover	9.23	7.25	1.98
Industry	8.59	6.03	2.56
Profitability	12.22	15.21	−2.99
Valuation Ratio	7.21	9.81	−2.60
Beta	13.46	13.65	−0.19
Variance of Returns	9.05	8.25	0.81
TOTAL	100.00	100.00	0.00
(*b*) *Return Judgments:*			
Net Assets	3.18	5.92	−2.74
Proprietorship Ratio	7.79	6.39	1.40
Liquidity	6.38	4.63	1.75
Sales Growth	14.03	9.45	4.58
Dividend Cover	9.78	5.40	4.38
Industry	9.34	6.04	3.30
Profitability	19.67	26.49	−6.82
Valuation Ratio	8.35	11.27	−2.92
Beta	13.99	17.66	−3.67
Variance of Returns	7.48	6.76	.72
TOTAL	100.00	100.00	0.00

B. Pairwise Pearson Product Moment Correlation Between Subjective and Objective Weights ($N=37$)

	Mean	*0%*	*25%*	*50%*	*75%*	*100%*
Risk Judgment	.30	−.41	.14	.33	.52	.87
Return Judgment	.32	−.26	.12	.36	.56	.79

S = Average subjective weight using 100-point subjective elicitation technique.

O = Average objective weight calculated as $O_i = \dfrac{|b_i|}{\sum_{i=1}^{10} |b_i|}$

on the available cue information [Ashton, 1974; Slovic, 1969; Slovic, Fleissner, and Bauman, 1972]. The correlation between these subjective weights and the standardized regression coefficients in the individual's regression model indicates self-insight.

Panel A of Table 1 summarizes the

subjective and objective weight indications for the risk and return judgment tasks. The subjective weight indications represent the perceived relative importance of each cue averaged across all individual judges. The objective weight indications represent the mean absolute percentage standardized regression coefficients obtained from the subjects' multivariate statistical judgment models.[4]

Consistent with prior research [Ashton, 1974; Hoffman, 1960; Hofstede and Hughes, 1977; Joyce, 1976; Slovic, Fleissner, and Bauman, 1972; and Summers, Taliaferro, and Fletcher, 1970b], the distribution of subjective weight indications is more even than the distribution of objective weights implied by the subjects' policy models. Subjects typically overestimate the importance they place on minor cues and underestimate the relative importance of a limited number of major cues. Furthermore, a comparison of the distributions of subjective cue weightings across judgment tasks indicates that analysts perceived the return judgment task to require a more highly differential cue utilization pattern than the risk judgment task.

Additional information on the self-insight performance of financial analysts at the individual level is reported in Panel B of Table 1. The mean correlation between subjective weights and objective weights is .30 (.32) for the risk (return) judgment task, with an interquartile range of [.14, .52] ([.12, .56]). This evidence indicates that financial analysts possess only moderate insight into the relative emphasis they place on the available information cues when generating their risk and return judgment evaluations.[5] The result is broadly consistent with prior research [Slovic, Fleissner, and Bauman, 1972; Wright, 1977, 1979] although some exceptions have been reported [Savich, 1977].[6]

Ability to Reproduce Actual Judgments

A second method of assessing judgmental self-insight investigates the ability of subjective weight models to accurately reproduce actual judgment evaluations [Cook and Stewart, 1975; Summers, Taliaferro, and Fletcher, 1970a; Wright, 1979]. In this sense, even if the correlation between subjective weights and objective weights is low, these discrepancies may have no significant impact on the ability of a subjective weight model to accurately reproduce actual judgments. For comparative purposes, the predictive ability of the subjective weight model is normally evaluated relative to an equal weight model which assumes that each cue is equally important in reproducing actual judgment policies [Ashton, 1974; Wright, 1977].

Table 2 presents the squared multiple correlations for the subject regression model (R_S^2), the model using subjective weights (R_I^2), and two models using equal (or unit) weights (R_E^2 and R_N^2). The only difference between the two equal weight models is that one model (R_E^2) specifies a directional expectation (positive, negative) based on an analysis of the distribution of signs of the estimated coefficients in the subject's regression model.

An analysis of Table 2 indicates that the proportion of variation in actual judgments explained by the subjective

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[4] The extent to which financial analysts made similar subjective (objective) weight indications was tested using Kendall's coefficient of concordance *W*. The null hypothesis of no relationship between the subjective (objective) weight indications across the $N=37$ judges is rejected ($\alpha=.05$) for both judgment tasks.

[5] An analysis of the relationship between self-insight and subject age, experience, job, and firm affiliation revealed no statistically significant associations.

[6] Self-insight correlations reported by Wright [1977, 1979] were .35, .42, .40, and .52. Slovic, Fleissner, and Bauman [1972] reported a correlation of .34 when using brokers as subjects and a correlation of .79 when using students for the same task. In contrast, Savich [1977] found a very high level of self-insight correlation, .92, in his study.

TABLE 2

SQUARED MULTIPLE CORRELATIONS

	(RISK JUDGMENTS)				*(RETURN JUDGMENTS)*			
	Quartile Information				*Quartile Information*			
	Mean	*25%*	*50%*	*75%*	*Mean*	*25%*	*50%*	*75%*
R_S^2	.726	.621	.736	.819	.736	.670	.746	.809
R_I^2	.341	.140	.365	.535	.329	.161	.318	.502
R_E^2	.307	.196	.314	.423	.251	.104	.254	.383
R_N^2	.087	.028	.073	.126	.227	.137	.235	.290
$R_S^2-R_I^2$	.385*	.239	.372	.492	.407*	.249	.387	.531
$R_S^2-R_E^2$	.419*	.315	.399	.511	.485*	.359	.429	.590
$R_I^2-R_E^2$	.034	−.076	.007	.108	.078*	.002	.094	.171
$R_I^2-R_N^2$	.254*	.055	.190	.478	.102*	.025	.083	.212
$R_E^2-R_N^2$	.219*	.129*	.224	.324	.024	−.091	.019	.138
P_I	.461	.216	.415	.667	.441	.242	.442	.652
P_E	.418	.301	.415	.559	.341	.143	.374	.529
P_N	.124	.039	.096	.195	.303	.218	.310	.394

$P_I=\frac{R_I^2}{R_S^2}$, $P_E=\frac{R_E^2}{R_S^2}$, and $P_N=\frac{R_N^2}{R_S^2}$

* Statistically significant ($\alpha=.05$) using paired sample t-test and Wilcoxon paired sample rank sum test.

weight models (R_I^2) is consistently higher than the variation in actual judgments explained by either of the two equal weight models. The difference $R_I^2-R_N^2$ was statistically significant ($\alpha=.05$) in both judgment tasks, and this result is broadly consistent with prior research findings [Cook and Stewart, 1975; Hoepfl and Huber, 1970; Nystedt and Magnusson, 1973; Summers, Taliaferro, and Fletcher, 1970a; and Wright, 1977].[7]

Following Wright [1977], R_I^2, R_E^2, and R_N^2 may be expressed as percentages of R_S^2 to compare the explanatory power of the subjective weight model and the two equal weight models relative to the explanatory power of the subject multiple regression models. These expressions are termed P_I, P_E, and P_N, respectively, in Table 2. Thus, for example, the subjective weight model explained a mean increase of 33.7 percent (i.e., $P_I(.461)-P_N(.124)=.337$) in the predictable variance of subjects' actual risk judgments relative to the unsigned equal weight risk model.

Correlation Between Predictions

A third method of assessing self-insight investigates the extent to which the regression equation of the subjective weight model "matches" the individual's optimal regression model. The underlying rationale to this approach is similar to the preceding section, although here we directly compare the predicted output of each model and thereby avoid any problems induced by the imperfect reliability of the judge.

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[7] Table 2 also indicates that the ability of the equal weight model to reproduce actual judgments is considerably enhanced by the inclusion of sign information. The difference $R_I^2-R_E^2$ for both judgment tasks is considerably smaller than the difference $R_I^2-R_N^2$. This is especially so for the risk judgment task where four of the five relatively more important cues (Net Assets, Proprietorship Ratio, Liquid Ratio, and Profitability) carried negative signs in the subjects' optimal regression models. Furthermore, for the risk judgment task the difference $R_E^2-R_N^2$ is statistically significant ($\alpha=.05$).

TABLE 3
ANALYSIS OF PREDICTED OUTPUTS

		Quartile Information		
	Mean	*25%*	*50%*	*75%*
(a) RISK JUDGMENT				
R^2_{SI}	.532	.362	.585	.709
R^2_{SE}	.418	.301	.416	.559
R^2_{SN}	.124	.039	.095	.195
$R^2_{SI}-R^2_{SE}$	.113	−.025	.065	.254
$R^2_{SI}-R^2_{SN}$	.408	.156	.451	.626
$R^2_{SE}-R^2_{SN}$	.294	.152	.325	.423
(b) RETURN JUDGMENT				
R^2_{SI}	.443	.232	.411	.652
R^2_{SE}	.333	.142	.356	.529
R^2_{SN}	.295	.179	.299	.389
$R^2_{SI}-R^2_{SE}$	.110	.003	.010	.228
$R^2_{SI}-R^2_{SN}$	.148	−.013	.112	.332
$R^2_{SE}-R^2_{SN}$	.039	−.112	.040	.186

Table 3 presents the squared multiple correlations between the predicted outputs of the individual's regression model, the subjective weight model (R^2_{SI}), and the two models using unit weights (R^2_{SE} and R^2_{SN}). These multiple correlations provide a measure of the degree to which the equations that generate $\hat{Y}_I$, $\hat{Y}_E$, and $\hat{Y}_N$ are similar to the individual's optimal regression equation.

An inspection of Table 3 indicates that the regression models with subjective weights as coefficients are effective *vis-a-vis* the equal weight models in predicting the outputs of the individual's optimal regression models. In both judgment tasks the differences $R^2_{SI}-R^2_{SE}$ and $R^2_{SI}-R^2_{SN}$ were statistically significant ($\alpha = .05$). These results confirm the findings reported earlier (concerning the ability to reproduce actual judgments) and indicate that the analysts were able to express indications of perceived cue importance which reflected the way that they were using the available cue information.[8]

SUMMARY AND CONCLUSIONS

This study investigated the extent to which financial analysts are aware of the relative importance they place on available information cues when generating judgments. Three different aspects of financial analyst insight were evaluated: the correlation between the subjective and objective weights themselves, the ability of the subjective weight models to reproduce actual judgments, and the degree of association between the predicted outputs of the subjective weight model and the individual's optimal regression model.

An analysis of the distribution of correlations between subjective and objective model weights indicated that the financial analysts possessed only moderate insight into their cue usage patterns. However, these discrepancies between subjective and objective weights did not significantly affect the ability of the subjective weight models to either reproduce actual judgment evaluations or to predict the outputs of the individuals' optimal regression policies. Linear models with subjective weights as coefficients were clearly superior *vis-a-vis* equal or unit weight models in predicting and reproducing actual judgment evaluations. These results indicate that the analysts were able to express indications of their relative cue importance which were consistent with the models and outputs of their judgment policies. In this respect the study provides continuing support for eliciting subjective opinions from business professionals regarding their information needs.

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[8] Analogous to Table 2, Table 3 indicates that the ability of the equal weight model to reproduce the predicted outputs of subject judgment models is enhanced by the inclusion of sign information. The proportion of variation in the $\hat{Y}_S$ explained by the equal weight model with sign information ($\hat{Y}_E$) is consistently higher than the unsigned equal weight model ($\hat{Y}_N$). Furthermore, the difference $R^2_{SE}-R^2_{SN}$ is statistically significant ($\alpha = .05$) in the risk judgment task. The result again reflects the relative numerosity of observed negative cue-criterion relationships in the risk judgment task.

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A Model of Auditors' Preliminary Evaluations of Internal Control from Audit Data

Donald R. Nichols

ABSTRACT: In this study, sections of working papers from audits performed by one office of a public accounting firm were obtained and investigated. The working papers contained the information documented from the preliminary evaluation of internal control over the accounts receivable/sales area. Data from the working papers were provided as input, and discriminant analysis was used to construct a descriptive model of the auditor preliminary evaluation judgments. The model correctly predicted about 80 percent of the individual auditor judgments, which is significantly more accurate than a chance model, and the importance of the presence or absence of particular control activities on the auditors' evaluations was investigated from the model.

THE auditor's study and evaluation of internal control has received increasing attention from public accounting firms and academic researchers in recent years. The study reported on here investigates the auditors' preliminary evaluations of internal control in actual audit engagements. Although the auditor is required to make a study and evaluation of the existing system of internal control for the purpose of determining the amount of reliance that may be placed on the system (SAS Sec.320.1), a variety of approaches to and descriptions of this process exist.[1] A diversity of auditor judgments of internal control evaluations was indicated in the Mock and Turner [1981] study, which found considerable variability in judgments and other aspects of the evaluation process, and they perceived a need for additional research [p. 125].

Several previous studies have investigated auditors' judgments in the evalua-

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[1] The disparity in conceptual approach (control objectives versus error analysis), research methods (flowchart versus questionnaire), and specific descriptions of the control structures is evident from comparisons of firm publications, such as Arthur Andersen [1985], Coopers & Lybrand [1978], Deloitte, Haskins & Sells [1979], Peat, Marwick, Mitchell & Co. [1983], Ernst and Whinney [1978], Price Waterhouse [1979], and Touche Ross [1979]. Whether the apparent differences in descriptions of control structures and the evaluation process produce disparate evaluations of control is beyond the scope of this study. Additional discussion of differences in firm publications and the auditing textbooks and literature may be found in Smith [1980] and Vasarhelyi [1980].

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tion of internal control in hypothetical settings [Ashton, 1974a, b; Ashton and Brown, 1980; Hamilton and Wright, 1977; and Reckers and Taylor, 1979]. Joyce [1976] and Mock and Turner [1981] investigated the effect of internal control evaluations on planned audit testing, while Gaumnitz et al. [1982] investigated both issues. The research methods of all of these previous studies have a number of similarities. All presented auditors with a series of hypothetical cases. The cases contained simplified descriptions of controls related to a type of transaction, and the auditors were requested to provide evaluations (only implicitly in the Joyce and Mock and Turner studies) of internal control. As with most research, these studies contained a number of limitations. Comments on the various studies and some of the limitations may be found in Ashton [1979] and Wright [1976]. Of some concern is the fact that, in such laboratory experiments, the potential exists for such problems as external validity of the experiments and the results. These problems are discussed in Einhorn [1976], Swieringa and Weick [1982], Ashton [1982], and Hogarth [1982].

In contrast, the data for this study came from working papers of actual audits, and the auditor judgments were preliminary evaluations of internal control in companies being audited. Because the judgments were made under actual working conditions, the external validity of the model and the analysis may be enhanced. Although this study investigates auditor judgments in the evaluation of internal control, it differs from previous studies in objectives as well as judgmental context. In particular, the objectives of this study were to construct a model from evaluations of auditors performing actual audits and to analyze the model for predictive ability and for inference of the relative importance of each particular control activity on the evaluation.

DATA COLLECTION

Copies of relevant sections of working papers from 125 actual audits were obtained from one office of a large public accounting firm. The working papers contained completed internal control questionnaires and documentation of the auditor's preliminary evaluation of control over accounts receivable/sales transactions. The company names were removed from the copies of the work papers for client confidentiality. The particular accounting firm office audits about 400 clients annually, and the selection of 125 was made by a member of the office personnel who was asked to select a sample of working papers from the files. Since the sample was not randomly selected and the auditors work for only one firm, some question of generalizability exists.

A number of companies were deleted from the original sample. Any not-for-profit organizations were eliminated from the analysis because audit objectives, and thus control evaluations, may be somewhat different for these clients than for profit-oriented organizations. Hospitals were eliminated from the analysis for the same reason and because the audit firm used a special internal control questionnaire for these organizations. A few companies were eliminated because the working papers indicated that the evaluation of internal control was not completed in the receivables area because of the small size of the receivables balance. Finally, a few companies were eliminated for incomplete data (primarily missing pages or uninterpretable evidence of the internal control structure or the specific preliminary evaluation). A total of 79 companies remained in the sample after these companies were eliminated.

DEVELOPMENT OF THE MODEL

For purposes of this research, the following five control activities were directly related to control over the validity and accuracy of accounts receivable.

1. *Separation of duties* (X_1)—There is a clear separation of duties between the accounts receivable ledger clerks, mail clerks, shipping clerks, and the cashier.
2. *Balancing* (X_2)—The accounting receivable subsidiary ledger is balanced with the general ledger control at least monthly.
3. *Monthly statements* (X_3)—Monthly statements are sent to all debtors by a disinterested party after comparison of statements to the subsidiary ledgers.
4. *Confirmation* (X_4)—Accounts receivable are confirmed on a surprise basis at reasonable intervals by internal auditors or other responsible parties.
5. *Verification* (X_5)—Sales invoices are checked for clerical accuracy in such things as pricing, footings, and extensions.

A two-group linear discriminant analysis model was used to model the auditor judgments. The basic objective of two-group linear discriminant analysis is to reduce a set of multiple measurements on one or more variables to single linear composite with values that maximally distinguish between members of the two groups. The functional form of the model is:

$$Z=c+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5$$

where the b_i are the discriminant weights, the X_i are the independent variables, Z is the factor for classification into a group, and c is a constant. The determination of the model and analysis was based on the DISCRIM program discussed in Eisenbeis and Avery [1972].

The firm's policies and forms resulted in the auditor's preliminary evaluation being dichotomous (preliminary reliance or nonreliance on the system of controls). The dependent variable (the auditor's evaluation) was coded zero when the decision was to rely on the system and one when the decision was to not rely. For each independent variable (control activity), the presence of the control ("yes" response on the questionnaire) was coded one and the absence of the control ("no" response) was coded zero.

Table 1 presents statistics regarding the five variables.

The discriminant model resulting from the 79 observations was as follows:

$$\begin{aligned}Z=&-4.1062+3.4087X_1\\&+1.5378X_2+1.2033X_3\\&+1.9877X_4+.7100X_5\end{aligned}$$

Each of the coefficients had the anticipated positive sign.

The validity of the model was inferred from its ability to predict the auditor's evaluation of each system given the information on the particular control elements present in the system. To obtain an unbiased measure of predictive accuracy of the model, the Lachenbruch method [Eisenbeis, 1977] was used. The Lachenbruch method produces unbiased measures of predictive accuracy from a sample without a designated holdout group. Basically, the approach holds out one observation at a time and computes the discriminant function from the remaining observations. This function is used to classify the observation that is held out. A second observation is held out, and all other observations are used to compute a discriminant function which provides a prediction of the sec-

TABLE 1

STATISTICS ON THE INDEPENDENT VARIABLES

Variable	*Mean*	*Standard Deviation*
X_1	.468	.502
X_2	.924	.267
X_3	.430	.498
X_4	.114	.320
X_5	.886	.319

Correlation Matrix for the Independent Variables

Variable	*1*	*2*	*3*	*4*	*5*
X_1	1.00	−.114	.311	−.172	−.143
X_2		1.00	−.137	.103	.047
X_3			1.00	−.010	−.070
X_4				1.00	.129
X_5					1.00

ond held-out observation. This one-at-a-time hold-out process is continued until all observations have been classified. The bias in this approach is virtually zero [Lachenbruch and Mickey, 1968].

The model predictions compared to actual auditor evaluations are shown in Table 2. There were 63 correctly classified observations (model prediction the same as the actual auditor evaluation) out of the 79 audits, representing 79.75 percent correct predictions.

A predictive ability of 79.75 percent is relatively high, and intuitively such a high degree of accuracy would not be likely to occur by chance. However, this presumption was tested using two different approaches. First, a simulation was performed by developing 500 LDM predictions and comparing these to randomly determined rely/not rely states. The random selection of the 79 values of the five independent variables in the LDM and the value of the dependent rely/not rely variable was from populations of values with the same proportions that existed in the 79 audit working papers in this study. The mean predictive accuracy of the process was 60 percent with only one of the 500 LDMs producing a predictive accuracy of more than 75 percent. This would suggest that the nearly 80 percent accuracy of the model in the actual audit context was not due to chance.

In addition, a statistical test for the significance of the difference between the predictive accuracy of the model and a proportional chance model is discussed in Joy and Tollefson [1975, 1978]. Application of their test statistic to the 79 observations indicated statistical significance at the .05 level. Thus, predictive ability of the model is relatively high (about 80 percent correctly predicted), and both tests indicated that this level of accuracy is not due to chance.

Because the variables are dichotomous, it is possible that a quadratic discriminant function might produce even greater predictive accuracy than the linear model. Gilbert [1968], Moore [1973],

TABLE 2

PREDICTED GROUP MEMBERSHIP VERSUS ACTUAL GROUP MEMBERSHIP

Actual Group	*Rely*	*Not Rely*	*Totals*
Rely	37 (46.8%)	11 (13.9%)	48 (60.8%)
Not Rely	5 (6.3%)	26 (32.9%)	31 (39.2%)
Total	42 (53.1%)	37 (46.8%)	79 (100%)

and Dillon and Goldstein [1978] have studied the effectiveness of linear versus quadratic functions when dichotomous data are involved, and their results would indicate that the linear model should be adequate for the data encountered in this study. To verify this, a quadratic model was derived from the data, but the predictive ability of the linear model was higher.

IMPORTANCE OF THE INDIVIDUAL CONTROL ELEMENTS

In this section, the importance of the individual control elements to the rely/not rely decision is inferred from the contribution of the variables to the discriminatory power of the model. There are no direct tests of significance of the coefficients of a discriminant model, since only the ratios of the coefficients, not the coefficients themselves, are unique. There are several approaches to ranking or measuring the importance of the individual variables on the predicted evaluation. The following discussion and analysis is based on Eisenbeis and Avery [1972] and Altman and Eisenbeis [1978]. The measures of the importance of the variables to the discriminating power of the model are inferred from (1) the significance of the univariate F-statistics, (2) the scaled discriminant function coefficients, and (3) the conditional deletion approach. The rankings of each variable's importance from these three approaches are presented as Roman numerals in Table 3.

The first approach provides a crude ranking of each variable based on the F-statistic for each variable, with a larger F implying a higher ranking. In the second approach, the coefficients are computed for normalized values of the independent variables (each variable is divided by its standard deviation to remove the scale effect) as described in Morrison [1967]. A larger coefficient implies a higher ranking. The third approach, conditional deletion, is described in Eisenbeis and Avery [1972] and is indicated by them to be the preferable approach. Essentially the method deletes each variable from an m variable set and computes the Wilks' lambdas for the remaining $m-1$ variables. The relative discriminatory power of the variables is inferred from the sizes of the residual Wilks' lambdas.

As shown in Table 3, the various approaches for assessing the importance of the variables produce similar results. Each would indicate that X_1 (separation of duties) was by far the most important variable in the model. This result is consistent with the previous research indicating that auditors appear to view separation of duties as the most important control activity in the areas studied. In all cases, variable X_5 (invoice verification)

TABLE 3

RELATIVE IMPORTANCE OF THE CONTROL ACTIVITIES

Variable	*F-Statistics*			*Scaled Coefficients*		*Conditional Deletion*	
X_1	32.79	(.00)	I	.44	I	.48	I
X_2	.31	(.58)	IV	.12	IV	.11	IV
X_3	9.541	(.00)	II	.17	III	.17	III
X_4	3.43	(.07)	III	.19	II	.18	II
X_5	.11	(.74)	V	.07	V	.07	V

appears to be the least important. Variables X_3 (mailing of monthly statements) and X_4 (surprise confirmations) appear to be about equally important, being ranked either II or III by all approaches. Variable X_2 (balance of subsidiary with control) is ranked IV by all approaches and appears to be only slightly more important than X_5.

Direct comparison of these results with previous research is difficult and risky. Most of the previous laboratory experiments involved payroll settings, and consequently the nature of the control structure and the audit context are different from the current study. However, Ashton [1974] and Ashton and Brown [1980] found that separation of duties was by far the most important control, accounting for 46 and 51 percent of the variance across all auditors. The current study shows separation of duties as 44–48 percent as measured by the scaled coefficient and conditional deletion approaches, respectively. The studies are thus consistent. The Ashton studies found that internal audit of payroll was not an especially important control (8.5 percent), and the current study generated similar findings, in that surprise confirmation by internal auditors produced a measure of 11–12 percent from the conditional deletion and the scaled coefficient methods, respectively. Again the studies appear to be consistent in the importance placed on internal audit activities. Other variables in the current study and the Ashton or other previous studies are not directly comparable.

SUMMARY

In this study, a predictive model of auditor preliminary evaluations was developed from actual audit data. The model produced reasonably high predictive accuracy, correctly predicting about 80 percent of the auditor evaluations. In addition, the importance of the individual control elements to the evaluation was investigated. Although direct comparison with previous research was not possible, the paramount importance of separation of duties was again indicated.

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EDITORIAL

Overview of Four Years of Submissions to THE ACCOUNTING REVIEW

This editorial shares with you some of my findings from a survey of accounting research over my four years as editor, as reflected in submissions to THE ACCOUNTING REVIEW. The categorization of manuscripts by topics and research methods is especially enlightening.

SUMMARY ANALYSIS OF SUBMISSIONS

A total of 1,148 papers were submitted to THE ACCOUNTING REVIEW from June 1982 through May 1986. Monthly submissions are shown in Table 1. These numbers do not include resubmissions of revised papers, which averaged about 80 per year (including resubmissions for third- and fourth-round reviews). Therefore, in 1982/83 and 1983/84 an average of about 6.7 new and revised papers were received each week; in the last two years this has increased to nearly 7.4 per week.

Table 2 summarizes the first-round editorial decisions for the 1,148 submitted papers. Sixty-three papers (5%) were returned because they were not appropriate for THE ACCOUNTING REVIEW. These were either papers with no research content or papers with no accounting content. Only 1% of the papers were accepted on the first round, 22% were sent back for revision, and 72% were rejected. Of the 1,085 papers sent to review (1,148 total−63 returned), 76% were rejected.

To analyze resubmitted papers, I will examine manuscripts submitted June 1982–May 1985 only. Many papers submitted for first-round review after May 1985 have not been finally resolved because of the time required for revision and the time taken by one or more additional review rounds. Table 3 shows that of the 166 papers sent back for revision, 133 (or 80%) were revised and resubmitted. Of the 133 resubmitted papers, 92 (or 69%) were eventually accepted after an average of 2.6 review rounds. Almost half of the 92 papers (47%) required only one revision. Twenty-eight papers were rejected, and 13 have reached no final decision yet. A few of these 13 are still under review, but most are cases where an author received a second revision recommendation but decided not to resubmit the paper. In sum, of the 166 papers receiving first-round revision recommendations, 92 (or 55%) have been accepted.

Thirty-eight initially rejected papers also were resubmitted. There is no automatic privilege to resubmit a rejected paper, so each of these required some justification from the author for resubmission. Seven (18%) were eventually accepted, 30 (79%) rejected (all but five on the second round), and one is still in the review process.

If one assumes that no further papers submitted before mid-1985 will be accepted,

TABLE 1
MANUSCRIPT SUBMISSIONS BY MONTH, JUNE 1982–MAY 1986

	Number of Submissions Each Month				*Cumulative Submissions for Preceding 12 Months*		
Month	*1982/83*	*1983/84*	*1984/85*	*1985/86*	*1983/84*	*1984/85*	*1985/86*
June	25	14	36	20	273	277	290
July	29	22	22	36	266	277	303
August	22	24	36	17	268	289	284
September	27	12	25	23	253	302	282
October	25	17	27	27	245	312	282
November	25	18	24	21	238	318	279
December	24	25	20	19	239	313	278
January	25	22	21	23	236	312	280
February	22	22	18	34	236	308	296
March	21	31	24	32	246	301	304
April	15	28	27	27	259	300	304
May	24	20	26	24	255	306	303
Total	284	255	306	303			

the number of June 1982–May 1985 submissions accepted is 11+92+7=110 papers accepted out of 845 submitted, or 13%. (Of the 791 papers *reviewed,* 14% were accepted.)

AUTHORS AND UNIVERSITIES

The 1,085 manuscripts sent to review were by over 1,100 different authors. Fifty-three percent of the papers had a single author, 34% had two authors, 11% three authors, and 1% four authors. (One paper had six authors.) Most authors (about 73%) submitted only one paper over the four-year period, and about two-thirds of them were only a co-author (rather than sole author) of the paper submitted. On the other hand, 31 authors submitted five or more papers, with nine papers the most submitted by any one person.

Papers were received from authors at nearly 250 U.S. and Canadian universities and 20 foreign countries. Less than 2% of the submissions were from individuals with no university affiliation. To appropriately assess submissions by university, each paper was weighted by one divided by the number of co-authors. (Thus, a paper submitted by four colleagues at the same university counts as one, not four, submissions by that university.) Almost 40% of the submitting universities had one or less than one submission. Twenty-five universities had over ten submissions and nine universities had over 15; the maximum was 23 submissions.

A total of 140 equivalent manuscripts were submitted from outside North America, 13% of the 1,085 submissions. Nearly three-quarters of the 140 came from the United Kingdom (41), Australia (37), or Israel (25). Other countries with submissions included Japan, New Zealand, Egypt, France, Greece, India, Austria, Finland, Italy, Korea, Luxembourg, Nigeria, Singapore, South Africa, West Germany, The Netherlands, and Spain.

TABLE 2
SUMMARY OF FIRST-ROUND EDITORIAL DECISIONS

		Accept	*Revise*	*Reject*	*Return*	*Total*
1982–83:	Number	2	59	195	28	284
	Percentage	1	21	69	10	101*
	Percent of Those Reviewed	1	23	76		100
1983–84:	Number	8	49	191	7	255
	Percentage	3	19	75	3	100
	Percent of Those Reviewed	3	20	77		100
1984–85:	Number	1	58	228	19	306
	Percentage	0	19	75	6	100
	Percent of Those Reviewed	0	20	79		99*
1985–86:	Number	0	83	211	9	303
	Percentage	0	27	70	3	100
	Percent of Those Reviewed	0	28	72		100
Total:	Number	11	249	825	63	1148
	Percentage	1	22	72	5	100
	Percent of Those Reviewed	1	23	76		100

* Rounding error.

TABLE 3
DISPOSITION OF RESUBMITTED MANUSCRIPTS

	Original Submission Year			
	1982/83	*1983/84*	*1984/85*	*Total*
Number of first-round revisions	59	49	58	166
Number of revisions resubmitted	49	39	45	133
Percentage resubmitted	83%	80%	78%	80%
Final Decisions:				
Accept: Number	30	39	33	92
Percentage	61%	74%	73%	69%
Average no. of review rounds	2.7	2.6	2.5	2.6
Reject: Number	16	6	6	28
Percentage	33%	15%	13%	21%
Average no. of review rounds	2.4	2	2.2	2.3
No final decision: Number	3	4	6	13
Percentage	6%	10%	13%	10%
Rejected manuscripts resubmitted	6	21	11	38
Final decisions:				
Accept: Number	1	4	2	7
Percentage	17%	19%	18%	18%
Average no. of review rounds	3.0	3.0	2.5	2.9
Reject: Number	5	17	8	30
Percentage	83%	81%	73%	79%
Average no. of review rounds	2.4	2.1	2.1	2.2
No final decision: Number	0	0	1	1
Percentage	0%	0%	9%	3%

CLASSIFICATION OF MANUSCRIPTS

Each manuscript sent to review (1,085, which is total submissions of 1,148 less the 63 returned without review) was classified by topic, sub-topic for financial, managerial, and audit papers, and research method. Tables 4, 5, 7, and 8 show the results of this classification.

Classifications are based on my subjective judgment, and others may have classified the papers differently. The results are not intended to be scientific; they are *my* assessment of the research submitted to THE ACCOUNTING REVIEW during my term as Editor. I tried to identify the *primary* subject and research method. However, there were limitations. For example, a paper that used analytic methods to develop hypotheses and then provided empirical tests of those hypotheses was invariably classified as an empirical paper. I made no attempt to determine whether the analytic development or empirical evidence provided the primary contribution. Another example would be a paper on inflation accounting whose main contribution was to the development of research methods. The subject of such a paper would still be inflation accounting.

TOPICS AND SUB-TOPICS

Nine topics and an "other" category had 15 or more submissions each. Financial, managerial, audit, and tax are mostly self-explanatory. However, I interpreted financial accounting to include all reporting issues, even though they may impact internal reporting also. Management accountants need to know whether different ways of reporting by oil and gas companies affect stock prices; nevertheless, such a paper was assigned to financial accounting.

Professional papers stress the professional practice of accounting firms, including evaluation of staff auditors, peer review, and professionals' attitudes about or approaches to issues such as small versus large firm standards, ethical issues, and many others. Research methods papers focused completely on such methods without direct application (other than an indication of how a method could be applied) to an accounting issue.

Papers classified as international assessed uniquely international aspects of an issue, such as surveys of or explanations for international differences in accounting practices. Papers on audit judgment in Australia or inflation accounting in the U.K. would not be classified as international. Foreign currency translation papers were called financial, not international. Similarly, nonprofit and governmental accounting required the special circumstances of such organizations to be a major influence on the research. A behavioral study on audit judgment would be classified "audit" even if government auditors were used as subjects, unless the primary hypotheses dealt with expectations that government auditors would differ from other auditors.

The information systems category includes a broad range of papers from office automation, to evaluation methods for accounting software, to the effects of different data storage systems on decision making, etc. The "other" category includes social accounting, historical studies not related to another topic, analyses of publication records of individuals or universities, application of the philosophy of science to accounting research, etc.

Financial accounting is the main topic of accounting research, with 41% of the

TABLE 4

TOPICS BY YEAR AND FIRST-ROUND DECISION

	1982–1983					*1983–1984*					*1984–1985*					*1985–1986*					*Total*					*%*
	Acc.	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*Pos.*
Financial	1	25	93	119	46	4	18	71	93	38	0	24	94	118	41	0	34	84	118	40	5	101	342	448	41	24
Managerial	0	13	37	50	20	1	7	31	39	16	0	13	41	54	19	0	15	38	53	18	1	48	147	196	18	25
Audit	0	10	25	35	14	2	11	33	46	19	0	16	34	50	17	0	16	33	49	17	2	53	125	180	17	31
Tax	0	3	10	13	5	1	3	9	13	5	0	2	9	11	4	0	9	11	20	7	1	17	39	57	5	32
Professional	0	1	6	7	3	0	2	8	10	4	0	0	13	13	5	0	1	14	15	5	0	4	41	45	4	9
Research Methods	0	1	4	5	2	0	1	11	12	5	0	1	9	10	3	0	5	7	12	4	0	8	31	39	4	21
International	0	2	4	6	2	0	0	4	4	2	0	0	6	6	2	0	1	5	6	2	0	3	19	22	2	14
Nonprofit/Govt.	0	0	6	6	2	0	2	2	4	2	0	0	5	5	2	0	0	6	6	2	0	2	19	21	2	10
Info. Systems	0	1	0	1	0	0	1	7	8	3	0	1	3	4	1	0	1	2	3	1	0	4	12	16	1	25
Other	1	3	10	14	5	0	4	15	19	8	1	1	14	16	6	0	1	11	12	4	2	9	50	61	6	18
Total	2	59	195	256	99*	8	49	191	248	102*	1	58	228	287	100	0	83	211	294	100	11	249	825	1085	100	24

* Rounding error.

submissions, as shown in Table 4. Managerial and audit are a close second and third with 18% and 17%, respectively. Tax leads the others, but is still a small portion (up to 7% in 1985–86) of the submissions.

The last column of Table 4, labelled "% Pos.," shows the percentage of papers in each topic that received either accept or revise decisions on the first-round submission. Tax papers had the highest rate (32%) of positive first-round editorial decisions, with professional papers the lowest (9%). An average of 24% of the papers sent to review received positive first-round decisions.

Table 5 shows the same type of information as Table 4, but it is broken into various sub-topics under financial, managerial, and audit. Papers on inflation (17% of the financial accounting submissions) and on prediction of earnings (9%) were the most common in financial accounting, but a wide variety of topics was represented—a full 47% were classified as "other." Earnings prediction papers had the best first-round decisions, with 40% receiving a positive first-round editorial decision. Budgeting and performance evaluation, which I found impossible to separate, led managerial submissions, both in numbers (33% of managerial accounting submissions) and in positive first-round decisions (38%). Cost-volume-profit and capital budgeting papers did not fare as well. Audit judgment and statistical sampling papers led the audit papers in quantity (22% and 22% of audit submissions, respectively) and quality (36% and 41% positive first-round decisions). Audit market papers are those about determinants of audit fees, reasons for switching auditors, the economic rationale for auditing, etc. They comprised 14% of audit submissions, and 19% received positive first-round decisions.

RESEARCH METHODS

Most papers could be classified into one of ten research methods categories. Table 6 describes the types of papers in each category. Many papers used more than one method; in those cases I classified them by what I considered to be the primary method. Table 7 shows that over one-fourth (27%) of the papers were classified as "general empirical." This is a catch-all that includes primarily descriptive empirical work. Almost the same number (28%) were in one of the four categories of modeling papers. Capital market research comprised 11% of the submissions and deductive research 9%. Historical and survey methods were used less often.

The highest percentage of positive first-round decisions was for simulation models (41%), although the sample size is small. Other categories with above average positive first-round reviews were general empirical, behavioral, capital market, and statistical modeling. Survey research fared by far the poorest, with only 3% positive first-round decisions. Empirical papers (general empirical, behavioral, capital market, and survey) comprised 57% of the submissions and had a 27% positive first-round review rate. Thirty-seven percent of the papers were nonempirical (modeling and deductive), and their positive first-round response was about 20%. Historical and other categories were not included in either empirical or non-empirical because they contain both types of research.

CROSS-CLASSIFICATION

Table 8 shows the research methods used within each of the topic areas, with Part A showing numbers of papers and Part B the percentage of papers in a given topic that

TABLE 5

FURTHER BREAKDOWN OF TOPICS FOR FINANCIAL, MANAGERIAL, AND AUDIT

	1982–1983					1983–1984					1984–1985					1985–1986					TOTAL					%
	Acc.	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*Pos.*
FINANCIAL:																										
Inflation	0	5	19	24	20	0	3	13	16	17	0	6	15	21	18	0	6	9	15	13	0	20	56	76	17	26
Earn. Pred.	0	5	3	8	7	1	3	3	7	8	0	4	12	16	14	0	4	7	11	9	1	16	25	42	9	40
Std. Setting	0	1	5	6	5	1	0	7	8	9	0	0	5	5	4	0	2	8	10	8	1	3	25	29	6	14
Bankruptcy Pred.	0	1	6	7	6	0	1	2	3	3	0	2	4	6	5	0	0	7	7	6	0	4	19	23	5	17
Cash Flow	0	0	1	1	1	0	1	3	4	4	0	1	5	6	5	0	2	3	5	4	0	4	12	16	4	25
Pensions	0	2	1	3	3	0	1	4	5	5	0	1	5	6	5	0	1	5	6	5	0	5	15	20	4	25
Foreign Currency	0	0	2	2	2	0	0	7	7	8	0	0	2	2	2	0	1	6	7	6	0	1	17	18	4	6
Ratios	0	1	4	5	4	0	0	3	3	3	0	1	3	4	3	0	0	3	3	3	0	2	13	15	3	13
Other	1	10	52	63	53	2	9	29	40	43	0	9	43	52	44	0	18	36	54	46	3	46	160	209	47	23
Total	1	25	93	119	101*	4	18	71	93	100	0	24	94	118	100	0	34	84	118	100	5	101	342	448	99*	24
MANAGERIAL:																										
Bud./Perf. Eval.	0	7	13	20	40	0	4	8	12	31	0	4	10	14	26	0	10	9	19	37	0	25	40	65	33	38
Cost Allocation	0	3	5	8	16	0	0	4	4	10	0	2	9	11	20	0	0	2	2	2	0	5	20	25	13	20
Standard Costs	0	1	3	4	8	0	0	3	3	8	0	2	5	7	13	0	4	10	14	27	0	7	21	28	14	25
CVP & Cost Beh.	0	1	5	6	12	0	0	6	6	15	0	0	2	2	4	0	0	5	5	10	0	1	18	19	10	5
Capital Budgeting	0	0	3	3	6	0	1	3	4	10	0	0	4	4	7	0	0	0	0	0	0	1	10	11	6	9
Other	0	1	8	9	18	1	2	7	10	26	0	5	11	16	30	0	1	12	13	24	1	9	38	48	24	21
Total	0	13	37	50	100	1	7	31	39	100	0	13	41	54	100	0	15	38	53	100	1	48	147	196	100	25
AUDIT:																										
Judgment	0	1	4	5	14	0	3	8	11	24	0	8	9	17	34	0	6	11	17	35	0	18	32	50	28	36
Stat. Sampling	0	3	8	11	31	1	4	7	12	26	0	5	4	9	18	0	3	4	7	13	1	15	23	39	22	41
Audit Market	0	2	2	4	11	0	2	4	6	13	0	0	3	3	6	0	1	12	13	28	0	5	21	26	14	19
Other	0	4	11	15	43	1	2	14	17	37	0	3	18	21	42	0	6	6	12	24	1	15	49	65	36	25
Total	0	10	25	35	99*	2	11	33	46	100	0	16	34	50	100*	0	16	33	49	100	2	53	125	180	100	31

* Rounding error.

Table 6

Examples of Research Methods

General Empirical

Relative accuracy of different earnings prediction models, effect of different treatments of convertible securities on EPS numbers, lobbying positions taken on accounting standards, differences in financial ratios under different reporting methods, economic characteristics of firms using different capital budgeting models, characteristics of audit firms that account for differences in audit fees, measures of aggregate taxpayer decisions in response to a tax law change, market concentration of audit firms, and comparison of reporting standards in a sample of countries.

Capital Market

Studies using stock market prices to measure reaction to accounting reports or standards, association of market risk measures with various accounting numbers, effect of qualified audit opinions on stock prices, and relation of reporting or auditing methods to market prices of municipal bonds.

Behavioral

Any accounting study conducted with student or professional subjects in a laboratory, questionnaire studies that have professionals reacting to research-created scenarios even if not in a laboratory, audit judgment based on varying circumstances, subjects' reaction to compensation plans with varying tax consequences.

Analytic Modeling

Markov chain model applied to estimation of warranty expense, linear-programming model for audit staff scheduling, game theory models for cost allocation, and data base models that accomplish specified objectives; these models have no *explicit* specific underlying economic theory.

Economic Modeling

Models based on agency theory, general equilibrium theory, neoclassical economics, etc.; these models differ from analytic models because their primary purpose is to bring economic analysis to bear on a topic such as analyses of pension accounting based on economic models of the labor market or agency models of the demand for auditing; they may be mathematical or verbal models.

Statistical Modeling

Models where the main focus is on statistical methods such as refinements of distributional assumptions in CVP analysis or dollar-unit sampling.

Simulation

Studies where analysis is complex so that computer simulation is necessary, such as in comparing bounds in audit sampling, testing heuristic approximations, or examining effects of tax law changes.

Deductive

Those deductive studies that do not fit into other categories, including opinion pieces; most papers in this category are primarily verbal, with a set of assumptions leading to a logical conclusion; examples are triple-entry bookkeeping, assessments of current status and future prospects for a type of research (e.g., management accounting research), developing inflation accounting methods by deduction from assumptions of what is to be disclosed, and specifying goals for an area of accounting research and developing a research strategy to reach those goals.

Historical

Papers that use archival methods to study an issue of current interest, for example, early contributions to inflation accounting, development of product costs in pre-1900 factories, or the structure of the audit profession.

Survey

Information gathered by questionnaire about practices or attitudes including studies of the types of capital budgeting models used by firms, attitudes toward Big-GAAP/Little-GAAP, and reasons staff give for leaving public accounting firms.

TABLE 7

RESEARCH METHODS BY YEAR AND FIRST-ROUND DECISION

	1982–1983					1983–1984					1984–1985					1985–1986					Total					
	Acc.	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*Acc.*	*Rev.*	*Rej.*	*Tot.*	*%*	*% Pos.*
General Empirical	0	15	47	62	24	1	21	55	77	31	0	15	53	68	24	0	26	59	85	29	1	77	214	292	27	27
Capital Market	0	10	24	34	13	1	7	20	28	11	0	8	17	25	9	0	14	18	32	11	1	39	79	119	11	34
Behavioral	1	10	26	37	14	1	11	26	38	15	1	13	34	48	17	0	12	37	39	17	3	46	123	172	16	28
Modeling:																										
Analytical	1	9	31	41	16	0	1	30	31	13	0	4	20	24	8	0	9	30	39	13	1	23	111	135	12	18
Economic	0	6	18	24	9	0	3	18	21	8	0	4	28	32	11	0	6	14	20	7	0	19	78	97	9	20
Statistical	0	1	4	5	2	2	3	8	13	5	0	3	9	12	4	0	3	7	10	3	2	10	28	40	4	30
Simulation	0	2	3	5	2	0	1	5	6	2	0	6	8	14	5	0	3	1	4	1	0	12	17	29	3	41
Deductive	0	4	25	29	11	1	1	17	19	8	0	4	22	26	9	0	5	21	26	9	1	14	85	100	9	15
Historical	0	0	7	7	3	2	0	5	7	3	0	0	14	14	5	0	3	8	11	4	2	3	34	39	4	13
Survey	0	0	6	6	2	0	0	4	4	2	0	0	13	13	5	0	1	10	11	4	0	1	33	34	3	3
Other	0	2	4	6	2	0	1	3	4	2	0	1	10	11	4	0	1	6	7	2	0	5	23	28	2	18
Total	2	59	195	256	98*	8	49	191	248	100	1	58	228	287	100	0	83	211	294	100	11	249	825	1085	100	24

* Rounding error.

used each of the research methods. For example, 37% of the financial accounting papers used general empirical methods, compared to only 8% of the managerial accounting papers, as much as 68% of international papers, and an overall average of 27%. Financial accounting research was heavily empirical (although 14% were deductive), managerial research was heavily nonempirical (except for behavioral at 23%). Capital market methods were used primarily for financial, research methods, and nonprofit/governmental papers, analytical models for managerial accounting, statistical and simulation models for auditing, and survey methods for professional and nonprofit/governmental. Table 8 provides a wealth of information, but it is mostly self-explanatory.

PUBLISHED ARTICLES

The topics and research methods of the articles published in April 1983 through January 1987, the issues for which I was responsible, are summarized in Table 9. There were 138 main articles, notes, and comments published. The number and percentage in each topic and research method category are listed, together with the number and percentage of submissions for comparison. Caution should be used in this comparison, because the submission base for the published articles differs slightly from that of the submissions listed in the table. Several papers submitted before June 1982 are listed among the published articles, and several of the papers among the 1982–86 submissions will be published after January 1987. However, the submission base is relatively stable across time, so the comparison is not unreasonable.

The percentage of published articles in each topic category is very close to the percentage submitted. Only financial (45% of the published articles versus 41% of the submitted papers) and research methods (1% of the published articles and 4% of the submitted papers) differ by more than one percentage point.

There is more variation by research method. The most popular research methods (general empirical, capital market, and behavioral) tend to comprise a higher percentage of the published papers than of the submitted papers, and vice versa. The methods where the percentage of submitted papers exceeds the percentage of published papers by the greatest margin are analytic modeling (12% versus 6%), deductive (9% versus 4%), and survey research (3% versus 1%).

The 138 published articles were written by 212 different authors from 83 different North American universities and 15 universities in seven foreign countries. Only 30 individuals were author or coauthor of more than one article, and only three of more than two. No university was responsible for more than five equivalent whole articles. Thirty-four universities had more than one equivalent article published, 16 had more than two, and only three universities had more than four. Sixteen equivalent papers, or 12% of the total, were by authors outside the U.S. and Canada. Authors without university affiliation accounted for four and one-half (or 3%) of the published articles.

REVIEWERS

It is fitting that I conclude this editorial with a word about the reviewers. They are the most critical factor in maintaining quality in a research journal. In the past four years, 529 different individuals have reviewed papers for THE ACCOUNTING REVIEW. There were seven associate editors, 82 review board members, and 440 ad hoc

TABLE 8

CROSS-CLASSIFICATION OF TOPICS AND RESEARCH METHODS

Topic	Gen. Empir.	Cap. Mkt.	Behav.	Analyt.	Modeling Econ.	Stat.	Simul.	Deduct.	Hist.	Surv.	Other	Total
A. Number of Manuscripts												
Financial	167	98	24	26	39	4	5	63	8	5	9	448
Managerial	15	0	45	71	31	7	2	13	7	1	4	196
Audit	45	1	60	21	12	23	13	1	0	2	2	180
Tax	17	3	10	9	5	0	6	3	2	1	1	57
Professional	7	0	13	2	1	0	0	2	5	15	0	45
Research Methods	4	10	7	0	0	6	2	3	2	1	4	39
International	15	1	0	0	0	0	0	2	4	0	0	22
Nonprofit/Govt.	4	4	2	1	1	0	0	2	1	6	0	21
Info. Systems	6	0	2	4	0	0	1	2	0	0	1	16
Other	12	2	9	1	8	0	0	9	10	3	7	61
Total	292	119	172	135	97	40	29	100	39	34	28	1085
B. Percentage Using a Given Research Method												
Financial	37	22	5	6	9	1	1	14	2	1	2	100
Managerial	8	0	23	36	16	4	1	7	4	1	2	102
Audit	25	1	33	12	7	13	7	1	0	1	1	101
Tax	30	5	18	16	9	0	11	5	4	2	2	102
Professional	16	0	29	4	2	0	0	4	11	33	0	99
Research Methods	10	26	18	0	0	15	5	8	5	3	10	100
International	68	5	0	0	0	0	0	9	18	0	0	100
Nonprofit/Govt.	19	19	10	5	5	0	0	10	5	29	0	102
Info. Systems	38	0	13	25	0	0	6	13	0	0	6	101
Other	20	3	15	2	13	0	0	15	16	5	11	100
Total	27	11	16	12	9	4	3	9	4	3	3	101

TABLE 9

COMPARISON OF PAPERS SUBMITTED TO ARTICLES PUBLISHED

Topic	*Number of Papers Submitted*	*Percentage of Papers Submitted*	*Number of Articles Published*	*Percentage of Articles Published*
Financial	448	41	62	45
Managerial	196	18	24	17
Audit	180	17	22	16
Tax	57	5	8	6
Professional	45	4	7	5
Research Methods	39	4	1	1
International	22	2	1	1
Nonprofit/Govt.	21	2	1	1
Info. Systems	16	1	3	2
Other	61	6	9	7
Total	1085	100	138	101*
Research Method:				
General Empirical	292	27	43	31
Capital Market	119	11	20	14
Behavioral	172	16	30	22
Modeling:				
Analytic	135	12	8	6
Economic	97	9	10	7
Statistical	40	4	6	4
Simulation	29	3	5	4
Deductive	100	9	6	4
Historical	39	4	3	2
Survey	34	3	1	1
Other	28	3	6	4
Total	1085	101*	138	99*

* Rounding error.

reviewers (excluding those who also served on the review board at some time during the four years). Any success the REVIEW has achieved over the last four years has been due to the countless hours devoted by this large set of reviewers. A goal of my editorship was to assure reviewers of their important role by keeping them well informed about decisions on the papers they reviewed. I hope this final report gives them and others still more helpful information about the submissions to the REVIEW.

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EDUCATION RESEARCH

Frank Selto, Editor

Inference from Empirical Research

David Burgstahler

ABSTRACT: Many researchers describe themselves as Bayesians in that they revise their prior beliefs based on observed empirical evidence. However, most studies are designed and reported as classical hypothesis tests, and research design issues are typically considered as determinants of abstract properties of statistical tests. Thus, although the primary function of empirical research is to influence beliefs, research design issues are seldom considered in their fundamental role as determinants of beliefs. In this paper, a Bayesian perspective is used to analyze the role of basic properties of hypothesis tests in the revision of beliefs. Two main points are emphasized. First, hypothesis tests with low power are not only undesirable *ex ante* (because of the low probability of observing significant results) but also *ex post* (because little probability revision should be induced even when significant results are observed). Second, irrespective of the usual issues of statistical and methodological validity, the effective level of tests in published research is likely to exceed the stated level, thus reducing the amount of probability revision justified by reported results. In combination, these conclusions are especially troublesome. If tests reported in the accounting literature are characterized by both low power and high effective levels, the results of published tests properly have little or no impact on the beliefs of a Bayesian. The Bayesian framework is useful in understanding and analyzing the tradeoffs which are an inherent part of empirical research. The analysis here identifies a Bayesian motivation for the common recommendations that researchers should attempt to maximize power in the design and execution of empirical tests and attempt to maintain the effective level of tests at their stated levels. Further, the analysis demonstrates the importance of explicit descriptions of research choices to allow (Bayesian) readers to properly revise their beliefs in response to reported empirical evidence. Finally, the model illustrates the role of prior beliefs and the characteristics of empirical tests in research and publication decisions.

THE merits of formal Bayesian methods have been discussed in numerous articles and books.[1] However, this discussion has had relatively little effect on the way research is conducted and reported in accounting and related fields.[2] Most studies are designed and reported in terms of classical hypothesis tests, and applications of formal Bayesian methods are the exception rather than the rule. Consequently, most empirical issues are analyzed only in terms

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of the effect on properties of classical hypothesis tests. The more fundamental issue of the effect on belief revision is not directly addressed.

Although formal Bayesian methods are seldom used, many accounting researchers describe themselves as Bayesians who revise their prior beliefs based on observed empirical evidence. The purpose of this paper is to explore the implications of a Bayesian approach to revising beliefs based on the reported results of classical hypothesis tests. This framework provides useful insights into the process by which empirical evidence is used to revise beliefs. For example, the Bayesian perspective demonstrates the distinction between statistical significance and statistical persuasiveness by showing that there are situations where statistically significant results should not lead to revision of the reader's prior beliefs. Further, the characteristics of the research and publication process suggest that these situations may not be unusual.

The remainder of the paper is organized as follows: After briefly reviewing the fundamentals of classical hypothesis testing in the following section, a Bayesian framework for integrating empirical evidence with prior beliefs to form posterior beliefs is described in the next section.[3] In this framework, three factors jointly determine posterior beliefs. The first two, the power and significance level of the empirical test, are discussed in the succeeding two sections. The third factor, prior beliefs, is discussed next along with other factors which influence research and publication decisions. Finally, a summary and conclusions are presented.

HYPOTHESIS TESTING

Development of a hypothesis test comprises three interrelated steps: (1) choose a test statistic, (2) derive the distribution of the test statistic under the null hypothesis, and (3) define a rejection region such that the probability of observing a test statistic in the rejection region if the null hypothesis holds is some (prespecified) significance level. If the observed value of the test statistic falls in the rejection region, the null hypothesis is rejected; otherwise, the null hypothesis is not rejected. Since the probability of the statistic falling in the rejection region if the null hypothesis holds is relatively small (i.e., equal to the level of significance), observation of a significant statistic is interpreted as evidence against the null hypothesis.

The preceding description omits some important aspects of the problem of designing a satisfactory hypothesis test, but the scope of published descriptions of hypothesis tests (and, by implication, the scope of issues considered in constructing tests) is often similarly limited. In developing and describing a hypothesis test, attention is typically focused on the significance level of the test. However, if the level of significance were the only concern, a random number generator could be used to construct an essentially costless test of any hypothesis.

Another critical concern is the power of the test.[4] The alternative hypothesis implies the distribution for the test statistic which determines the power of the

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[1] See, for example, Savage [1954], Raiffa and Schlaifer [1961], Edwards, Lindman, and Savage [1963], or Zellner [1971].

[2] Efron [1986] suggests several factors which may explain why most scientific data analysis is carried out in a non-Bayesian framework.

[3] Similar models are found in Zellner [1971, Chapter 10] and Judge et al. [1985].

[4] In the larger context of a decision problem, the loss function must also be viewed as an integral part of hypothesis testing (see Savage [1954, Chapter 16]).

test, i.e., the probability that the test statistic will fall in the rejection region (will be significant) when the alternative hypothesis holds.[5]

In evaluating results of completed empirical research, there tends to be an emphasis on either the null or the alternative hypothesis distribution, but not both. When a significant test statistic is observed, factors which might have caused the effective level of the test to exceed the stated level are explored. On the other hand, when the observed test statistic is not significant, factors which might have caused the power of the test to be low are examined. However, as emphasized in the following sections, both the level and power of a test are important *regardless of the outcome of the test*, i.e., regardless of whether the observed statistic is significant.

A BAYESIAN FRAMEWORK FOR INTEGRATING EMPIRICAL EVIDENCE

Let H_0 and H_A, respectively, denote the null and alternative hypotheses. Let the observation of a significant test statistic be denoted by *S* and observation of a nonsignificant test statistic by *NS*. Finally, let the probability of observing *S* when the null hypothesis holds be α and let the probability of observing *NS* when the alternative holds be β. Then the following familiar table of probabilities of observing *S* or *NS* conditional on H_0 or H_A applies:

CONDITIONAL PROBABILITIES OF OUTCOMES

		State	
		H_0	H_A
Value of Test Statistic	*NS*	$P[NS\|H_0]=1-\alpha$	$P[NS\|H_A]=\beta$
	S	$P[S\|H_0]=\alpha$	$P[S\|H_A]=1-\beta$

A Bayesian will combine prior beliefs about H_0 with observed empirical evidence to form a posterior belief. For example, the posterior belief in H_0 given that empirical evidence *S* is observed is:

$$P[H_0|S]=\frac{P[S|H_0]P[H_0]}{P[S|H_0]P[H_0]+P[S|H_A]P[H_A]}=\frac{\alpha P[H_0]}{\alpha P[H_0]+(1-\beta)P[H_A]} \tag{1}$$

where $P[H_0]$ and $P[H_A]$ denote the prior beliefs in H_0 and H_A, respectively. Similarly,

$$P[H_A|S]=\frac{(1-\beta)P[H_A]}{\alpha P[H_0]+(1-\beta)P[H_A]} =1-P[H_0|S] \tag{2}$$

In the following sections, the posterior belief in the null hypothesis given observation of a significant statistic, $P[H_0|S]$, is discussed as a function of the power of the test $(1-\beta)$, the level of the test (α), and the prior belief in the null $(P[H_0])$.[6]

POWER AS A DETERMINANT OF POSTERIORS

Although the issue of power is often discussed when a nonsignificant test sta-

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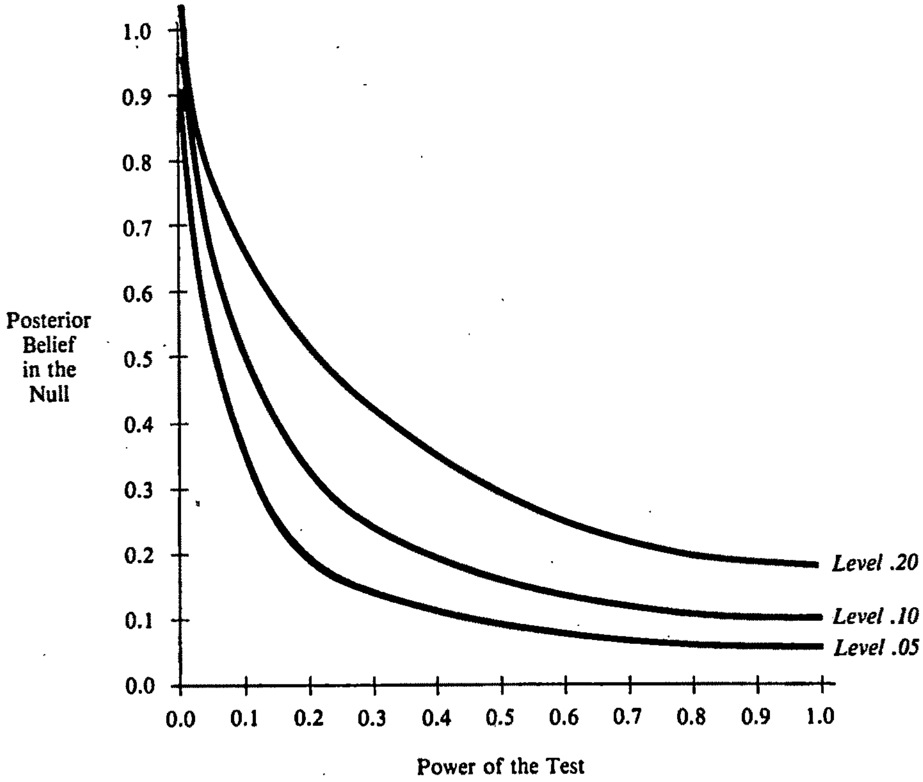
[5] Composite alternative hypotheses would imply a set of alternative hypothesis distributions, giving rise to a power function defined over the set of alternative hypotheses. Since composite alternative hypotheses complicate the exposition without changing the qualitative conclusions, only simple alternatives are considered here. For an application of the model in Section 3 to composite alternatives, see Zellner [1971].

[6] Since $P[H_0|S]=1-P[H_A|S]$, discussion of the posterior belief in the alternative hypothesis would be logically equivalent.

FIGURE 1

POSTERIOR BELIEF IN THE NULL AFTER OBSERVING A SIGNIFICANT TEST STATISTIC (FOR PRIOR BELIEF OF .5)



tistic is observed, the importance of power when a significant statistic is observed has received little attention.[7] The power of a test which has resulted in a significant test statistic is commonly viewed as a moot issue; there seems little reason to be concerned with the power of a test which has been "powerful enough" to yield a significant test statistic. However, equations (1) and (2) show that power $(1-\beta)$ remains a critical component of the belief revision process even when a significant test statistic is observed. A Bayesian cannot know how (or even whether) to revise beliefs in response to a significant test statistic without knowledge of the power of the test.

This point can be further illustrated by examining posterior beliefs given observation of a significant test statistic as a function of power. Figure 1 plots the relationship between posterior belief in the null hypothesis and power of the test for three different significance levels,

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[7] For example, Cook and Campbell [1979, p. 40] emphasize the importance of analysis of power when no effect is observed but do not mention the importance of power when a significant effect is observed. See also Simonds and Collins [1978, pp. 649-650], Foster [1980, p. 41], Foster [1981, pp. 220-222], Ball and Foster [1982, p. 186], Beaver [1982, pp. 327-328], and Kinney [1986, pp. 345-348].

.05, .10, and .20, with prior beliefs $P[H_0]=P[H_A]=.5$.[8] For more powerful tests, there is a lower degree of belief in the null (and greater belief in the alternative) as a result of observation of a significant statistic.[9] If the power of a test is as low as the significance level of the test, then the posterior will be unchanged from the prior *regardless of the outcome of the test.*[10] This is illustrated in Figure 1 where posterior beliefs are seen to be equal to the prior belief (.5) at the value where power is equal to the level of the test. Intuitively, when a significant test statistic is equally likely under the null and alternative hypotheses (i.e., when the level and power of the test are the same), results of the test do not change beliefs about the null hypothesis.[11]

In empirical accounting research, decisions made by researchers often result in bias toward non-rejection of the null hypothesis, i.e., they reduce the power of the test.[12] The *ex ante* risk that the reduction in power will result in insignificant (and probably unpublishable) results is well-known and widely acknowledged. However, it is not widely recognized that this is more than an *ex ante* problem. Even if the results from a test with low power are significant, the results have little value; even significant results from a low-power test do not cause much change in a Bayesian's beliefs about the null hypothesis.

Researchers sometimes expect a single set of data to serve two purposes. Results are calculated to decide whether a test is sufficiently powerful as well as to draw a conclusion about the hypothesis being tested. In fact, researchers may even mistakenly assert that a significant result from a low-power test is more convincing evidence against the null than a significant result from a high-power test because a more extreme test statistic is required to attain significance for a low-power test.[13] However, not all tests which yield significant results are powerful tests and it is inappropriate to judge the power of a test based solely on the significance of the observed results. Moreover, from equations (1) and (2) it is clear that the power of the test is a required input to Bayesian belief revision in response to empirical results.

In summary, the power of a test is critical in drawing inferences from empirical results. The statement that significant results are evidence against the null hypothesis is, by itself, incomplete; significant results are only strong evidence against the null for powerful tests.

EFFECTIVE LEVEL OF PUBLISHED EMPIRICAL TESTS

The role of the effective level of published tests in belief revision is illustrated by the three curves in Figure 1 which show posterior beliefs for tests of three different significance levels. Observation of a test statistic significant at a lower level, α, results in a lower posterior belief in the null hypothesis, $P[H_0|S]$. Thus, the effective level of a published result is a critical component of the belief revision process for a Bayesian.

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[8] The specific significance levels and prior beliefs plotted in Figure 1 were chosen to provide quantitative examples, but similar qualitative conclusions would apply for any (non-dogmatic) priors and any (non-zero) significance levels.

[9] Note, however, that even for a test with power of 1.0, a significant statistic does not result in a posterior belief in the alternative of 1.0 unless the level of the test is 0.0. An ideal test with power 1.0 and level 0.0 would enable the researcher to reason by logical implication rather than by statistical inference (see Bakan [1966]).

[10] When the power of the test is less than the effective level of the test, observation of a "significant" test statistic actually results in an *increased* belief in the null hypothesis. In this somewhat perverse situation, referred to as a biased hypothesis test [Mood, Graybill, and Boes, 1974], a significant test statistic is actually more likely under the null than under the alternative and thus increases belief in the null.

[11] Thus, a "significant" test statistic from the random number generator mentioned earlier would not change beliefs because a significant test statistic would be equally likely under the null and alternative hypotheses.

[12] For some specific examples, see Beaver, Clarke, and Wright [1979, pp. 326–327], Beaver, Lambert, and Morse [1980, pp. 11–12], and Bowen, Noreen, and Lacey [1981, p. 178].

[13] For example, Zmijewski and Hagerman [1981, p. 138] construct a test so as "to intentionally bias the estimator in favor of the null hypothesis to provide for a stronger test." Similarly, Bakan [1966] concludes that a significant result from a test with a small sample size is more convincing than a significant result from a test with a larger sample size.

The publication process serves as a filter which affects the probability of observing a published significant test statistic when the null hypothesis holds.[14] Some of the incentives which determine the characteristics of this filter are discussed in the following section. In this section, behavioral factors which may cause the effective level of the tests reported in the literature to exceed their nominal level are discussed.[15] These behaviors create biases which are described below as researcher-induced or editor-induced, though the categories are not always distinct. Researchers may be aware of many of these biases individually but their joint and cumulative effects are not often considered, nor is their impact on a Bayesian integration of empirical evidence with prior beliefs.

Researcher-induced biases are the result of choices made in the course of a research project. Greenwald [1975, p. 3] summarizes a number of researcher behaviors which lead to a high probability of observing significant results in published research even when the null hypothesis holds (i.e., a high effective level for published tests), including:

1. submitting results for publication more often when the null hypothesis has been rejected than when it has not been rejected;
2. continuing research on a problem when results have been close to rejection of the null hypothesis ('near significant'), while abandoning the problem if rejection of the null hypothesis is not close;
3. elevating ancillary hypothesis tests or fortuitous findings to prominence in reports of studies for which the major dependent variables did not provide a clear rejection of the null hypothesis;
4. revising otherwise adequate operationalizations of variables when unable to obtain rejection of the null hypothesis and continuing to revise until the null hypothesis is (at last!) rejected or until the problem is abandoned without publication;
5. failing to report initial data collections (renamed as 'pilot data' or 'false starts') in a series of studies that eventually leads to a prediction-confirming rejection of the null hypothesis; and
6. failing to detect data analysis errors when an analysis has rejected the null hypothesis by miscomputation, while vigilantly checking and rechecking computations if the null hypothesis has not been rejected.

The effective significance level of published results may also be increased by a practice sometimes described as "refining a theory" in the course of a research project. For example, a project might begin with a theory which suggests the direction of a relationship between two or more variables but is not sufficiently refined to specify the precise functional form of the relationship between the dependent variable and the independent variables. The theory may not be sufficiently well-developed to specify which variables should be included, whether the relationship should be linear or quadratic, or whether the effects of independent variables are additive or multiplicative. As the research progresses, the theory is sometimes "refined" by trying several functional forms and selecting the one which is most consistent with the data. For example, Bowen [1981] explicitly uses significance and consistency with theory as criteria for choosing a particular functional form for a regression equation.[16] When data-fitting is used to refine the form of a regression equation and the same data are used for hypothesis tests, the effective significance level of the test may substantially exceed the stated level.[17]

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[14] Further discussion of this point is found in Sterling [1959], Bakan [1966], Lykken [1968], Walster and Cleary [1970], Greenwald [1975], and McCloskey [1983].

[15] The discussion in this section focuses on some behavioral factors which may lead to invalid nominal significance levels. A more general discussion of threats to validity is found in Cook and Campbell [1979].

The most troublesome aspect of the behaviors discussed above is that their precise effects on the effective level of published tests are difficult to identify and even more difficult to quantify. However, it would be naïve to conclude that because the effects cannot easily be quantified, they must be unimportant. Rather, researchers must attempt to minimize these effects by meticulous adherence to carefully planned research designs. Researchers should begin with a well-developed theory which specifies the relevant variables and the functional form of the relationship. Whenever possible, major research decisions such as operational definitions of variables, data to be collected, and sample sizes should be made in advance and researchers should be reluctant to modify the research plan unless the modified plan is viewed as a separate test requiring new data. Only by conducting carefully planned tests of well-developed theories can researchers effectively control the significance level of reported tests.

The proportion of incorrect rejections in published research is also increased by the behavior of journal editors and reviewers. If, as casual empiricism suggests, stricter editorial standards are applied to completed research with nonsignificant results, the proportion of published incorrect rejections of the null hypothesis will be higher than implied by the nominal level of the tests.[18] In fact, if only rejections of null hypotheses were published, then, even for a correct null hypothesis, the probability of observing a published study which rejects the hypothesis would increase rapidly as the number of tests of the hypothesis increased.[19]

Most researchers conscientiously attempt to avoid the behaviors described above, though few can claim to be free of their effects. Also, although there is probably some editorial bias against publishing insignificant results, editors generally do not follow a policy of simply publishing all significant results and rejecting all nonsignificant results. Well-designed and executed research is published despite statistically insignificant results; poorly-designed and executed research is rejected despite statistically significant results.

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[16] While other researchers in accounting undoubtedly consider significance and consistency in selecting a model to be used for significance tests, Bowen is especially conscientious in explicitly reporting his criteria. When specifications are tried and discarded without being reported, the reader has no way to assess the impact of alternative specifications on the effective level of the reported tests. For other specific examples, see McCloskey's [1985] description of a sample of ten recent papers from economics using regression analysis, of which only two do not admit experimenting with alternative specifications.

[17] Freedman [1983] demonstrates how seriously the effective significance level can be distorted by selecting variables for inclusion in a regression equation based on significance of the individual coefficients.

[18] In order to eliminate the bias in acceptance criteria, Walster and Cleary [1970] suggest an editorial policy in which data and results are withheld when an article is submitted for review so that publication decisions are based on the design rather than the results. Kinney [1986] suggests a similar policy for evaluating dissertation research.

[19] To make the risk of observing a significant result purely by chance more concrete, let k be the number of independent tests conducted, all at level α. Then, the probability of observing at least one rejection of the hypothesis is $1-(1-\alpha)^k$. As k goes from 1 to 5 to 10, the probability of observing at least one rejection goes from .05 to .22 to .40 for $\alpha=.05$ and from .10 to .40 to .65 for $\alpha=.10$.

Nonetheless, the conclusion remains: If any of these behaviors is exhibited by researchers or editors, the effective proportion of published incorrect rejections of null hypotheses may systematically exceed the proportion implied by the nominal level of the tests conducted. As a consequence, the belief revision by a Bayesian in response to a published empirical result should be less than would be implied by the (incorrect) nominal level of significance. Moreover, readers attempting to integrate published results with their prior beliefs cannot determine the effects of unrecorded choices made by researchers and editors and thus are missing a critical input to the belief revision process.[20, 21]

PRIOR BELIEFS AND INCENTIVES FOR RESEARCH PRODUCTION AND DISSEMINATION

The role of prior beliefs in belief revision is clear from equations (1) and (2); posterior beliefs are directly related to prior beliefs and individuals with different prior beliefs will have different posterior beliefs. In this section, the discussion focuses on another aspect of prior beliefs, the role of prior beliefs in research and publication decisions. Prior beliefs influence decisions because of their role in researchers' perceptions of the probable outcome of proposed research projects and in editors' interpretations of submitted results. The influence of prior beliefs is complex; researchers' decisions reflect perceptions of editors' beliefs and editors' decisions are influenced by perceptions of researchers' beliefs.

A test of a hypothesis must satisfy two necessary conditions to be considered for publication: The hypothesis (1) must not be trivial, and (2) must not be quasi-certain. A null hypothesis not related to a substantive economic issue is trivial. A null hypothesis for which substantially all researchers hold prior beliefs "close to" zero or for which substantially all researchers hold prior beliefs "close to" one is quasi-certain. The results of a test of a quasi-certain hypothesis are not informative because they are "close to" perfectly predictable.[22] The tastes and preferences of an editor determine how these definitions are operationalized. The results of tests of hypotheses which an editor deems trivial or quasi-certain will not be published. In the remainder of this section, all hypotheses contemplated by researchers and editors are assumed to meet these two necessary conditions.

Editors may be reluctant to publish significant results when prior beliefs are strong, i.e., when the prior belief in the null hypothesis is either very low or very high. When the prior belief in the null

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[20] Based on a number of assumptions about researcher and editor behaviors, Greenwald [1975] estimated that the proportion of incorrect rejections of null hypotheses appearing in the social psychology literature may be as high as .30 (for tests conducted at the .05 level). Although this estimate does not necessarily apply to research in accounting (since different behavioral assumptions would lead to different estimates of the proportion of incorrect rejections), it does give an impression of the potential magnitude of the effects of these biases.

[21] The level of published tests remains a concern even with publication of the results of more than one test of a hypothesis. Christie [1985] proposes an interesting technique for combining evidence from separate tests of a hypothesis. Since the technique requires valid assessments of effective significance levels for the individual tests, correct nominal significance levels are essential.

[22] It might seem that test results inconsistent with highly certain priors would be especially interesting. However, as illustrated in the following paragraph, unless it can be established that the test had very high power and a very low significance level, it may be more likely that the results are incorrect than that the prior beliefs are incorrect.

is low, significant results are consistent with the priors and may not change beliefs much.[23] An editor may be reluctant to expend resources to publish results that merely confirm strong prior beliefs. On the other hand, when the prior belief in the null is high, an editor may also be reluctant to publish significant results. For example, with a prior belief in the null of .95, significant results from a test with a level .10 and power of .90 would cause posteriors to be revised downward to approximately .68, a fairly substantial revision of beliefs. However, the posterior belief in the null hypothesis given a significant test statistic can also be interpreted as the probability that the significant results are "incorrect." Thus, the posteriors indicate that the odds are greater than two to one that the significant result is "incorrect!" Because editors are likely to be reluctant to publish a result that has a high probability of being incorrect, hypotheses for which priors are strong require especially high-power tests with carefully controlled significance levels.

A primary purpose of publishing the results of empirical research is to influence researcher beliefs about a hypothesis and thus influence the further development of theory. However, a secondary effect, apparent from equation (3) below, is that changes in beliefs affect the expected utility to other researchers of devoting resources to tests of a hypothesis. Thus, publication of results which are largely consistent with prior beliefs can be valuable when the results strengthen beliefs so that other researchers will not choose to expend additional resources to conduct tests of the hypothesis.[24]

A researcher will choose the research project, P, which maximizes expected utility, $E(U^P)$,[25]

$$\begin{aligned} E(U^P) = {} & P(H_0)E(U^P|H_0) + \\ & P(H_A)E(U^P|H_A) \\ = {} & P(H_0)\{(1-\alpha)U[H_0,NS] + \\ & \alpha U[H_0,S]\} + \\ & P(H_A)\{\beta U[H_A,NS] + \\ & (1-\beta)U[H_A,S]\}. \end{aligned} \tag{3}$$

The expected utility of a proposed project depends on prior beliefs about the hypothesis as well as the power and level of the proposed hypothesis test. Different researchers may have different prior beliefs and may have access to tests with different powers, or have different perceptions of the power of a given test. These differences, along with other factors, lead different researchers to choose different research projects.[26]

The expected utility of a proposed project also depends on the utility of the state/outcome combinations. Publications are major determinants of the decisions which determine most monetary and nonmonetary rewards for academic researchers, including promotion and tenure decisions, salary increases, consulting rates, and job changes. Consequently, the utility of each state/outcome combination depends primarily on the product of the reward to publication and the probability of publication. Publications that deal with more important

[23] The extreme case is the test of a hypothesis which is obviously false; significant results from a test of such a (quasi-) certain hypothesis do not change beliefs at all.

[24] A third purpose of publication is to support and disseminate methodological innovation which improves the level and power of subsequent tests, thus increasing the belief revision supported by the results of subsequent research.

[25] More generally, researchers and editors must choose a set of research projects rather than just a single research project. Choosing a portfolio of projects which maximizes expected utility is a more complex problem than the one considered here and raises additional issues beyond the scope of this discussion.

[26] The utility-maximizing P^* may be the null research project which allows a researcher to engage in alternative activities, e.g., consulting or consumption of leisure.

hypotheses and that have a larger impact on beliefs are likely to lead to greater rewards to the researcher. The probability of publication depends on researcher perceptions of editorial policies and beliefs.

If, as suggested in the previous section, researchers perceive that significant results are much more likely to be published, then researchers will choose the project which yields an optimal combination of probability of significant results and low cost. Assuming that the utility for significant results ("rejecting the null") is much higher when the null is false, researchers will prefer powerful tests of null hypotheses for which they have low prior beliefs. Thus, the utility-maximizing project may be a powerful test of a hypothesis which the researcher believes is likely to be false. However, powerful tests of hypotheses are often costly; for example, a high-power test may require a large amount of researcher time for data collection and analysis or may require that the researcher acquire additional expertise. Consequently, the utility-maximizing research project could also be a low-power, but low-cost, test of a null hypothesis which the researcher believes is likely to be false.

Under some circumstances, researchers could also have high utility for rejecting a true hypothesis. For example, researchers may have high utility for publishing significant, but incorrect, results if subsequent results which contradict the original results are not likely to be published until after some decision affected by publication (e.g., tenure) has been made. Alternatively, for very costly tests or tests for which it is difficult to assess power, there may be little chance that a replication contradicting the results will ever be conducted and published to reveal an error. Even if subsequent tests reveal that the hypothesis is true, the impact on the original researcher's reputation and wealth may be small as long as there is no evidence of deceit or incompetence. Thus, because of the possibility of observing significant results even when the null hypothesis holds, the utility-maximizing research project might be a low-cost test of a null hypothesis which the researcher believes is likely to be true. In fact, in choosing a project from the set of research projects for which the power of the test is nearly as low as the level, the primary consideration would be the cost of available tests, rather than researcher beliefs about the hypotheses.

Prior beliefs play an important role throughout the research process. They directly determine posterior beliefs as shown in equations (1) and (2). However, they also play an important role in the decisions of editors and researchers. Further, the power and level of available tests and the costs associated with each test are determinants of researcher decisions. The model presented in this section helps to clarify the relationships among these factors in research decisions.

CONCLUSIONS

Research practices which lower the power of tests have sometimes been accepted in accounting research without consideration of their implications. Similarly, the implications of research and editorial practices which increase the effective level of reported tests have received little attention. The model discussed in this paper demonstrates that tests with low power are not only undesirable *ex ante*, because of the low probability of observing significant results, but also *ex post*, because little probability revision should be induced by the results of low-power tests regardless of whether significant results are observed.

Further, the discussion suggests that, irrespective of the usual issues of statistical and methodological validity, the effective level of tests in published research is likely to exceed the stated level, thus reducing the amount of belief revision justified by reported results.

The Bayesian framework presented here is useful in analyzing and understanding the trade-offs which are an inherent part of empirical research. The model clarifies the relationship between research decisions and characteristics of tests, prior beliefs, and individual utilities. Broadly stated, the recommendations which follow from the analysis are little different from those of an introductory discussion of experimental design: Researchers should attempt to maximize power in the design and execution of empirical tests and attempt to maintain the effective level of tests at their stated levels. However, the analysis identifies the reasons for these recommendations. The results of tests with low power have little value (even if the results are statistically significant) because low-power tests should induce little belief revision regardless of their outcome. Behaviors which increase the effective level of published empirical tests are undesirable because an increase in the effective level is accompanied by a decrease in the belief revision justified by the results. If these recommendations were not followed, published empirical results would properly have little or no effect on the beliefs of accounting researchers.

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An Evaluation of AICPA Tests for Predicting the Performance of Accounting Majors

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ABSTRACT: This paper examines the marginal contribution of scores on the AICPA level I achievement test and aptitude test for predicting the performance of students in upper division courses. Three performance measures were studied: grades in all upper division courses, grades in upper division accounting courses, and a binary variable reflecting whether a student made a C or below on an upper division accounting course. Results for each of these measures indicated that the AICPA scores did not improve significantly the predictive ability of models that included lower division grades. Several limitations of the study are described.

PURPOSE OF THE STUDY

THIS paper extends earlier research that attempted to predict student performance in accounting courses. The study employs scores on the AICPA level I achievement and AICPA aptitude tests as explanatory variables.[1] In addition, the study presents some refinements to the methodologies used in prior research.

The criteria examined in this study are the scores on aptitude and achievement tests developed by the AICPA. These tests were developed by the AICPA to assist accounting faculty and administrators in conseling and admitting students. Use of these tests for counseling and program admission decisions may be indicated if their marginal predictive ability can justify their costs. Since the tests are costly to purchase, maintain, and administer, it is worthwhile to examine the extent to which the tests provide useful information beyond that which can be obtained from readily available information such as prior grades and ACT/SAT scores.[2] The specific objective of this study was to assess the margi-

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[1] This report summarizes the analysis of data collected as part of a longer-term project which we hope will permit extended analysis of a variety of student performance measures. The data are being collected with the partial support of the AICPA Testing Office and the Accounting Department of the University of Iowa.

[2] The AICPA Testing Office charges $3.00 per student for the tests and scoring. Other costs include the time required for a faculty member or assistant to administer the tests and the cost of preparing a data file to store test results for each student and retrieval for processing. The filing and processing costs may be minimal if other files are already maintained in a form that permits additional data items, such as the test scores, to be added.

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Both authors were on the faculty of the University of Iowa when this research project was initiated.

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nal predictive ability of the AICPA tests in conjunction with other predictors of performance. We present results of the ability of the factors to predict the performance of students in upper division courses at the University of Iowa during the 1984–1985 academic year.[3]

Prior Research

Several earlier studies used dichotomous discriminant analysis and a variety of explanatory variables to classify the (binary) performance of accounting students [Clark and Sweeney, 1985; Delaney et al., 1979; Dockweiler and Willis, 1984; and Eckel and Johnson, 1983]. These variables included grade-point average, grades in specific lower division courses, ACT/SAT scores, and scores on similar standardized tests. Several of these factors appeared to be associated with the success or failure of students. In general, the most important of these was a measure of prior grade-point average.

Two prior studies [Buehlemann, 1975, and McCormick and Montgomery, 1974] examined AICPA achievement test scores as correlates of the performance of accounting students, especially transfer students. Both studies concluded that the AICPA tests could be used to evaluate students for counseling. However, neither of these studies developed prediction models or evaluated the performance of the AICPA test scores when used with other explanatory variables.

Description of the Study

Beginning with the fall semester of 1984, all students wishing to major in accounting at the University of Iowa were required to apply for specific admission to the accounting program.[4] All students admitted to the program were required to take the AICPA aptitude and AICPA level I achievement tests (Form C). The achievement test covers material normally taught in introductory financial and managerial accounting courses. Both tests are multiple choice, and each requires 50 minutes to complete. The tests were administered to intermediate financial accounting I students in testing sessions outside of class during the second week of classes during the 1984 fall semester and were scored by the AICPA Educational Testing Office.

Students were informed that the test scores would be used for counseling and advising purposes and that the accounting faculty was interested in determining whether the scores were useful for predicting performance in accounting courses. No other incentives were provided to encourage the students to perform well on the tests. The lack of additional incentives may be a limitation of the study, although overall, the students performed well on the tests and discussions with students after the tests did not reveal any incentive problem.[5]

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[3] Only a tentative link can be made in this study between the AICPA tests and admission to accounting programs. The study is based on test scores and performance measures of students who were already admitted to the accounting program. Accordingly, the marginal predictive ability of the AICPA tests might be used in this study to screen out some students who otherwise were admitted to the program. However, in this study, the tests could not be used in decisions to admit students to the program since it was not feasible to have all students seeking admission take the tests. The study does provide a description of how the AICPA test scores could be used for admission decisions if the tests were required of applicants. The same procedures could be used for placing students in honors sections or other special courses, if needed.

[4] The sample consisted of 122 students who were in the junior class at the University of Iowa. Enlarging the study to include other students at the University of Iowa and students at other universities may be important for developing predictive models and for evaluating the AICPA tests. Students at Iowa may not be representative of students at other universities, especially because of the admission requirements for the program. Approximately 200 students are admitted to the accounting program at the University of Iowa at the junior level each year. The students in the sample used in this study had average composite ACT scores of 25.7 and average grade-point averages for the first two years of college of 3.4. Seventy-one percent of the sample had A's in the first accounting course and 54 percent had A's in the second course.

The initial group tested included 122 students. These students comprised the sample for the results described in this study. These students had been admitted into the accounting program based on grades in two introductory accounting courses (A's or B's were required in both courses), overall grade-point average (gpa), ACT scores, and letters of reference. All but the last of these criteria were included as independent variables in the prediction tests in addition to the AICPA test scores. Since grades, ACT scores, and gpa are readily available at minimal cost, they provided a useful criterion to measure the marginal predictive ability of the AICPA test scores.

The AICPA aptitude test provided four performance measures: a total aptitude score, a verbal score, a quantitative score, and a problem-solving score. Each of these scores was included as an independent variable in the research tests. The variables were intercorrelated and yielded similar results. All of the variables were included in the study because different measurement scales were involved and because each variable may be of interest to accounting educators.[6]

Three dependent variables were examined: the students' overall gpa during the fall and spring semesters of the 1984–85 academic year, the students' accounting gpa on three upper division accounting courses taken by all of the students during this period, and a binary variable representing students who made grades "below B" on upper division accounting courses or those who made only grades of "B and above."[7]

Methodological Issues

The measurement scale of some of the variables included in the study affected the way these variables were used. The grade requirement for the introductory accounting courses limited the variability of these numbers. They were treated as dichotomous variables ($0=B,\ 1=A$). The gpa and ACT variables were approximately normally distributed and were treated as continuous variables.[8] The accounting grade average was skewed and was not continuous. Since only three grades were included in the measure, the variable could take on values of 4.0, 3.67, 3.33, 3.0, etc. in a 4.0 scale system. Therefore, we chose to treat this variable as a classificatory variable.[9] Only six classes of grade averages were observed in the data. These were coded as 0=2.33, 1=2.67, 2=3.0, 3=3.33, 4=3.67, 5=4.0.

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[5] Mean percentile scores (standard deviations) for the achievement, composite aptitude, verbal, quantitative, and problem-solving measures, respectively, were 84.6 (17.7), 86.0 (11.9), 79.2 (16.0), 91.9 (8.7), and 83.5 (16.2).

[6] Since predictive ability was the primary concern of the study, multicollinearity was not of primary importance. However, since we are also interested in the stability of model coefficients and our ability to generalize the models to other subjects, we examined the possible effects of multicollinearity. Variance Inflation Factors (VIF's) were calculated for each independent variable (see Neter et al. [1985, pp. 390–393]). All of the VIF's were less than 1.3 (indicating no serious multicollinearity) except for the aptitude scores. These scores were highly intercorrelated. We tested the effects of the intercorrelation on the model coefficients by including only one aptitude measure in the model at a time. None of the measures was significant and the results reported later in this study were not changed in any perceptible way.

[7] The courses were intermediate financial accounting I and II and cost accounting. The last dependent variable was included for purposes of comparing results of this study with those of earlier studies. Any split of the sample for discriminant purposes is arbitrary. We chose to separate students into the "below B" and "B and above" groups because one goal of admission into the program at the University of Iowa was to identify students who would do at least B-level work in accounting. Also, this grouping produced approximately equal group sizes. Splitting the observations according to other criteria (e.g., a 3.0 average on upper division courses) produced results very similar to those reported in the results section.

[8] Chi-square goodness of fit tests were used. The variables were not significantly different from a normal distribution at the .10 level.

[9] Treating accounting gpa as a classificatory variable permitted the use of statistical procedures (i.e., logit analysis) which were not sensitive to the distribution of the dependent variable. Since the data were inherently classificatory, no loss of information resulted.

Ordinary least-squares regression was used to develop an association model for the gpa variable. The model was specified as follows:

$$\begin{aligned} GPA85 = {} & GPA84 + ACT + A1 + A2 \\ & + ACH + APT + VERB \\ & + QUAN + PSOLV, \end{aligned} \tag{1}$$

where

$GPA85$ = total gpa for academic 1984–1985,
$GPA84$ = gpa for first two years of college,
ACT = total score on ACT test,
$A1$ = dichotomous variable for grade in first accounting course,
$A2$ = dichotomous variable for grade in second accounting course,
ACH = score on AICPA achievement test,
APT = total score on AICPA aptitude test,
$VERB$ = verbal score on AICPA aptitude test,
$QUAN$ = quantitative score on AICPA aptitude test, and
$PSOLV$ = problem solving score on AICPA aptitude test.

The purpose of this study was not simply to develop an association model but also to provide a device that would predict the performance of students in the accounting program subsequent to admission. Given the relatively small sample size and a desire to test the sensitivity of the models to variations in the sample, we used a Monte Carlo random sampling with replacement procedure referred to as the bootstrap method (for discussion, see Efron and Gong [1983]).

The procedure, as used in this study, works as follows: a set of observations of size *n* is drawn from the sample by independent random sampling with replacement. Regression coefficients are computed for the set of observations. The process is repeated a large number of times and a distribution is formed of the regression coefficients. Significance tests are then performed on the distributions. In addition, predictions of the dependent variable were computed for each observation in the sample from the coefficients derived in each trial. Actual and predicted values of the dependent variable were correlated to assess the predictive ability of the models. This process permits assessment of the stability of regression coefficients and prediction results, adjusting for a bias that may result from overfitting the model when a small sample is used. The sample size (n) was 122 for this study and 50 replications were used.

Multiple logit analysis (see Harrell [1980]) was used to develop association models for the accounting gpa variable because of the discrete nature of the variable.[10] The model was specified as follows:

$$\begin{aligned} ACCT = {} & GPA84 + ACT + A1 + A2 \\ & + ACH + APT + VERB \\ & + QUAN + PSOLV, \end{aligned} \tag{2}$$

where the variables have the same meaning as in (1), and $ACCT$ = the accounting score based on grades in two intermediate financial courses and a cost accounting course. The same bootstrap procedure was used for assessing the predictive abilities of the variables for $ACCT$ as was used for $GPA85$. Rank correlation statistics were examined for

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[10] Multiple logit analysis is a regression-type procedure designed specifically for models in which the dependent variable can take on multichotomous values.

TABLE 1

BOOTSTRAP OLS REGRESSION RESULTS FOR 1985 GRADE-POINT AVERAGE

Variable	*Coefficient*	*Standard Error*	*t-Score*	*Probability*
First Accounting Course Grade	−.0315	.0192	−1.64	.126
Second Accounting Course Grade	.1006	.0251	4.01	.001
ACT Score	−.0002	.0020	−0.10	.748
GPA—Fall 1984	.9503	.0571	16.66	.001
Achievement Score	.0013	.0008	1.63	.136
Aptitude Score	−.0046	.0082	−0.56	.550
Verbal Score	.0055	.0039	1.41	.174
Quantitative Score	.0017	.0020	0.85	.388
Problem-Solving Score	.0043	.0026	1.61	.152

the *ACCT* variable because of the discrete nature of the variable.

Additional models were developed for the *GPA*85 and *ACCT* variables which included only the *GPA*84, *ACT*, *A*1, and *A*2 variables. These reduced models were useful for determining the marginal contribution of the omitted AICPA test score variables for predicting student performance. If the omitted variables are important for predicting performance, the correlation statistics between actual and predicted performance should be higher for the full than the reduced models and *F*-tests for reduced error sum of squares should be significant.

Logistic regression was used to test whether the independent variables were useful for classifying a binary dependent variable. Observations were coded zero for students who received a grade of C or lower in an upper division accounting course and one for other students. Full and reduced models were used in this analysis as in the tests of the other dependent variables. Classification tables were compared between the full and reduced models to determine the contribution of the AICPA test scores to the models' classification abilities.

Test Results

Table 1 reports the results of the bootstrap OLS regression models for the *GPA*85 variable. The table reports the mean and standard error of the coefficients for the 50 trials and the resulting *t*-score. OLS regression coefficients and significance levels for the sample as a whole (without bootstrapping) are reported in Table 2 for comparative purposes.

We anticipated that the sign for the coefficients of each of the variables would be positive. However, the coefficient for the grade in the first accounting course (*A*1), the ACT score (*ACT*), and the aptitude score (*APT*) were negative on average. The grade in the second accounting course (*A*2) and the grade-point average for the first two years of college (*GPA*84) were significant at the .01 level. *GPA* 84 was significant at the .0001 level. None of the other variables was significant at the .10 level.

The R^2 for the models was .832. The corresponding *F*-value was 26.5, significant at the .0001 level. Thus, the models provided a good fit for the *GPA*85 variable in spite of the instability of some of

TABLE 2
OLS REGRESSION RESULTS FOR 1985 GRADE-POINT AVERAGE
(TOTAL SAMPLE)

Variable	*Coefficient*	*Standard Error*	*t-Score*	*Probability*
First Accounting Course Grade	−.0561	.1078	−.52	.585
Second Accounting Course Grade	.0902	.1070	.84	.327
ACT Score	.0074	.0921	.80	.421
GPA—1984	.9159	.0724	12.65	.001
Achievement Score	.0048	.0032	1.50	.130
Aptitude Score	−.0171	.0244	−.70	.448
Verbal Score	.0043	.0975	.44	.530
Quantitative Score	.0019	.0955	.21	.651
Problem-Solving Score	.0022	.0248	.09	.782

the coefficients. The predictive ability of the models was good as well. The average correlation coefficient between the actual and predicted values of *GPA*85 was .880 for the 50 trials with a standard deviation of .021.

The AICPA test scores contributed minimally to the predictive ability of the models. The average correlation coefficient (between actual and predicted GPA's) for the reduced models (with the AICPA scores omitted) was .804. Thus, the correlation coefficient declined by only .076, on average, when the test scores were omitted from the models. An *F*-test for the marginal reduction in the error sum of squares (see Neter et al. [1985, p. 291]) provided by the AICPA test scores was not significant at the .10 level. The *F*-score was .448 (2,60 degrees of freedom) based on an average error sum of squares (50 trials) of 1.952 for the reduced model and 1.943 for the full model.

The *GPA*84 variable contributed most to the predictive ability of the models. The average correlation coefficient for models in which only this variable was included was .791. Thus, approximately 80 percent ($.791^2/.880^2$) of the predictive power of the full model was provided by the *GPA*84 variable.

Table 3 provides similar statistics for the bootstrap multiple logit models for the accounting grade variable. The *ACT*, *A*1, and *APT* variables all have negative signs, on average, in these models. The *GPA*84 and *A*2 variables were significant at the .01 level. None of the other variables was significant at the .10 level.

The predictive power of the models was not as high for *ACCT* as for *GPA*85. The average rank correlation coefficient between actual and predicted accounting grades for the models was .596 with a standard deviation of .054. The rank correlation declined to .568 when the AICPA test scores were omitted from the models. Thus, AICPA test scores contributed minimally to the predictive power of the models.

Classification results for the logistic regression tests using a binary dependent variable are reported in Table 4 for the total sample. The results are consistent with the earlier results in that the full model, including the AICPA scores, adds little to the classification ability of the reduced model. The correct classification rate for the full model was 75.4 percent compared to 74.6 percent for the reduced model. This relationship did not change materially when holdout samples were used for predictive purposes (not

TABLE 3

BOOTSTRAP LOGISTIC REGRESSION RESULTS FOR 1985 ACCOUNTING GRADES

Variable	*Coefficient*	*Standard Error*	t-*Score*	*Probability*
First Accounting Course Grade	−.196	.405	−.48	.582
Second Accounting Course Grade	1.798	.366	4.92	.001
ACT Score	−.022	.073	−.30	.722
GPA—1984	3.985	.475	8.39	.001
Achievement Score	.014	.016	.88	.370
Aptitude Score	−.287	.239	−1.20	.289
Verbal Score	.090	.067	1.35	.217
Quantitative Score	.082	.070	1.18	.284
Problem-Solving Score	.210	.134	1.56	.149

TABLE 4

BINARY CLASSIFICATION RESULTS FOR LOGISTIC REGRESSION MODELS FOR ACCOUNTING GRADES

	Predicted		
Actual	*Below B**	*B and Above*	*Total*
Full Model:			
Below B	44 (74.6%)	15 (25.4%)	59
B and Above	15 (23.8%)	48 (76.2%)	63
Total	59	63	122
Reduced Model:			
Below B	44 (74.6%)	15 (25.4%)	59
B and Above	16 (25.4%)	47 (74.6%)	63
Total	60	62	122

* The observations were grouped based on whether a student made a grade below B on any upper division accounting course or grades of B and above only.

reported). These classification results are similar to those of earlier studies. Clark and Sweeney [1985] report correct classification rates of about 73–80 percent in their models.

CONCLUSIONS

By far the most important variable for predicting accounting student performance in upper division courses was the students' gpa's for the first two years of college. None of the other variables examined in this study provided a significant improvement in predictive power.

To justify the costs associated with the AICPA tests, some net benefit should be obtained from their use. In the tests examined in this study, a significant net benefit was not observed. While the achievement test score was observed to be positively correlated with student performance (a correlation statistic of .32 was observed between the achievement test scores and the students' gpa's), the test score provided little marginal explanatory or predictive power when considered in conjunction with other explanatory variables.

LIMITATIONS AND SUGGESTIONS FOR FUTURE RESEARCH

Several important limitations exist in this study which restrict the generalizability of the findings. These include the size, location, and other attributes of the sample and the performance measures included in the tests. The effect of each of these limitations on the result should be examined before strong conclusions are reached. Since similar research at other universities has resulted in consistent findings with those presented in this study, it appears that sample attributes did not have a major effect on the results. Nevertheless, extending the research to other students may be useful.

Future research should examine the use of the AICPA tests as admission criteria. A sample of students at a university considering implementation of admissions requirements into the accounting program could be examined to see whether the tests contribute to distinguishing among student performance. AICPA test results could be used to group students into prospective admit and nonadmit categories. Performance of students in the two groups could then be examined to determine whether the tests are effective in distinguishing students who perform well in the program from those who do not.

The performance measures included in this study were limited to overall and accounting gpa's during the students' junior years. Additional performance measures also may be important. These might include student performance on all undergraduate and all upper division courses, performance in graduate accounting programs, whether students complete their accounting degrees, whether they complete their degrees on a timely basis, what career choices they make, what kind of job offers they receive, professional exam results, and career progression. The concept of performance is subtle and, therefore, difficult to capture. Grades in specific courses probably do not adequately identify important aspects of performance. An extension of these tests over time should allow researchers to examine alternative performance measures by tracking student success throughout college and into their careers.

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Charge: 1. To develop and issue position statements on matters relating to accounting education.

2. To develop and recommend to the Executive Committee educational policy for the Association.

3. To initiate, coordinate, and administer the activities of the Association in the field of accounting education, including accounting education research.

4. To coordinate the work of committees for the Doctoral Consortium, New Faculty Consortium, Trueblood Seminars, Professional Examinations, and other education-related committees that may be established during the year.

Chairman: Loren A. Nikolai, University of Missouri-Columbia
Bruce Baldwin, Portland State University
John D. Bazley, University of Denver
Thomas H. Beechy, York University
B. Gary Dando, Ernst & Whinney, Cleveland
Thomas P. Howard, University of Missouri-Columbia
Salvatore Luiso, Coopers & Lybrand, New York
Donald L. Madden, University of Kentucky
Belverd E. Needles, Jr., DePaul University
Lawrence C. Phillips, University of Miami
Jack Topiol, Community College of Philadelphia

ACCOUNTING EDUCATOR AWARD COMMITTEE

Charge: To select one, two, or, at most, three recipients of the Outstanding Educator Award using the criteria approved by the Executive Committee.

Chairman: Paul P. Danos, University of Michigan
William J. Bruns, Jr., Harvard University
Lorraine Hicks, State Technical Institute at Memphis
Albert R. Mitchell, Arthur Young & Company, Reston, VA
Theodore J. Mock, University of Southern California
Gary L. Sundem, University of Washington

ACCREDITATION COMMITTEE

Charge: 1. To advise and make recommendations to the Executive Committee, as appropriate, regarding the role of the AAA in the accounting accreditation process, and the actions that the AAA can take to assist members in complying with AACSB accounting accreditation requirements.

2. To monitor the activities of, and work with, the appropriate committees of the AACSB regarding accreditation to assure that the accreditation standards are applied fairly, yet flexibly, in the process of accrediting programs that possess strong academic qualifications.

3. To serve as liaison with the AACSB in helping qualified academics serve as accreditation teams.

Chairman: James R. Boatsman, Arizona State University
William F. Bentz, University of Oklahoma
David A. Dittman, University of Minnesota
Rick Elam, University of Missouri-Columbia
William Markell, University of Delaware
James R. Peters, Ernst & Whinney, Cleveland

CARTER SCHOLARSHIPS COMMITTEE

Charge: 1. To collect and evaluate applications for the Carter Funded Student Scholarships.

2. To recommend amounts of stipends.

3. To rank applications and to transmit the ranking to the trustees of the fund.

Chairman: William V. Voss, Ohio University
Jose Gonzalez, Kent State University
Phyllis B. Webster, University of North Carolina at Greensboro

CHANGES IN ACCOUNTING EDUCATION COMMITTEE

Charge: To document, in as much detail as possible, the most significant changes that have occurred in accounting education during the past 25 years so that we might better anticipate the near-term difficulties inherent in making further changes, including some of those recommended in the 1986 (AAA) Report of the Committee on the Future Structure, Content, and Scope of Accounting Education.

Chairman: Jay M. Smith, Jr., Brigham Young University
Richard D. Boley, Georgetown University
Bruce P. Budge, University of Montana
Michael Chatfield, California State University, Hayward
Alan P. Johnson, California State University-Hayward
David H. Luthy, Utah State University
Robert H. Strawser, Texas A & M University
Milton F. Usry, Jr., University of West Florida

COMPETITIVE MANUSCRIPT AWARD COMMITTEE

Charge: To select recipient(s) of the Competitive Manuscript Award.

Chairman: Andrew D. Bailey, Jr., Ohio State University
Robert H. Ashton, Duke University
Chee W. Chow, San Diego State University
Bala G. Dharan, Rice University
Edward J. Joyce, University of Minnesota
David E. Mielke, Marquette University

DELOITTE HASKINS & SELLS WILDMAN MEDAL COMMITTEE

Charge: To administer the John R. Wildman Medal in accordance with the terms of the grant from the Deloitte Haskins & Sells Foundation.

Chairman: Stephen E. Loeb, University of Maryland
Stanley F. Biggs, University of Connecticut
Michael Gibbins, University of Alberta
Gerald L. Salamon, Indiana University
Gerald A. Sena, Deloitte Haskins & Sells, New York
Robert B. Sweeney, Memphis State University

DOCTORAL CONSORTIUM COMMITTEE

Charge: 1. To plan the 1987 Doctoral Consortium.

2. Upon approval and funding, to arrange to have the consortium conducted and administered.

3. To report on its results, effectiveness, and recommended changes by November 1, 1987.

Chairman: Daniel W. Collins, University of Iowa
Dan S. Dhaliwal, University of Arizona
Paul A. Griffin, University of California-Davis
James Jiambalvo, University of Washington
James C. Noel, Carnegie-Mellon University

DOCTORAL PROGRAMS COMMITTEE

Charge: 1. To carry out the plans previously made for the 1987 Doctoral Programs Conferences.

2. To evaluate the value of all prior Doctoral Programs Conferences and recommend to the Director of Education whether or not this program should be continued and, if so, how it might be improved. Funding of future committees and conferences should also be studied.

Chairman: Terry L. Campbell, Penn State University
Bart P. Hartman, Louisiana State University
Thomas H. Williams, University of Wisconsin-Madison

FINANCIAL ACCOUNTING STANDARDS COMMITTEE

Charge: To evaluate selected discussion memoranda and exposure drafts related to financial accounting in the private sector as they are released by the Financial Accounting Standards Board, and to respond to the FASB in writing and by appearing at public hearings if necessary.

Chairman: W. Thomas Harrison, Baylor University
Paul R. Brown, Yale University
James W. Deskins, Wichita State University
Wayne Landsman, University of California-Los Angeles
Katherine Schipper, University of Chicago
Ray G. Stephens, Ohio State University
Janet Vincent, Arthur Young & Co., Los Angeles

FUTURE STRUCTURE FOLLOW-UP COMMITTEE

Charge: 1. To work with the regional vice-presidents in scheduling and staffing, at each 1987 spring regional meeting, one discussion session on the more important issues inherent in the 1986 (AAA) Report of the Committee on the Future Structure, Content, and Scope of Accounting Education.

2. To prepare a survey instrument that will poll those attending the regional discussion sessions to determine their degree of agreement with and support for the most important features of the 1986 Report.

3. To summarize the findings of the regional surveys and to present these findings at a concurrent session of the 1987 annual meeting in Cincinnati.

Chairman: Marc F. Massoud, Claremont McKenna College
Ernest E. Bartholomew, Arthur Young & Co., Baltimore
Jerry M. Daily, Touche Ross & Co., New York
Nabil M. Hassan, Wright State University
Clark Johnson, Johnson & Johnson Co.
Gary Luoma, University of Southern California
Mohamed Onsi, Syracuse University
Larry E. Rittenberg, University of Wisconsin-Madison
Bill N. Schwartz, Temple University
Edward L. Summers, University of Texas at Austin

INTERNATIONAL FACULTY EXCHANGE COMMITTEE

Charge: 1. To select the professors to be involved in the program for 1987–88.

2. To assist the Executive Director with the arrangements and the distribution of necessary materials for the visits.

Chairman: Yuji Ijiri, Carnegie-Mellon University
Bryan V. Carsberg, OFTEL, Office of Telecommunications, London
W. Morley Lemon, University of Waterloo
Gerhard G. Mueller, University of Washington
Daniel G. Short, University of Texas at Austin

INVESTMENTS COMMITTEE

Charge: To recommend to the Executive Director how surplus AAA funds should be invested.

Chairman: Jerry J. Weygandt, University of Wisconsin-Madison
Harold Q. Langenderfer, University of North Carolina at Chapel Hill
William G. Shenkir, University of Virginia

MEMBERSHIP COMMITTEE

Charge: To increase the quantity and quality of the membership of the Association.

Chairman: Robert A. Holtfreter, Fort Hays State University
Members:
Alabama—Judith Kamniker, Auburn University at Montgomery
Alaska—E. Thomas Robinson, University of Alaska-Fairbanks
Arizona—Curtis L. DeBerg, Arizona State University
Arkansas—Doris M. Cook, University of Arkansas
California—Anwar Salimi, California State University-Sacramento; Ronald Stone, California State University-Northridge
Colorado—Mary Virginia Parker, University of Colorado at Denver
Connecticut—Mahendra Gujarathi, University of Connecticut
Delaware—Lester Chadwick, University of Delaware
Florida—Kathryn M. Means, Florida Atlantic University
Georgia—Ernest R. Larkins, Georgia State University
Hawaii—Shirley Daniel, University of Hawaii-Honolulu
Idaho—Mike R. Ruble, University of Idaho
Illinois—J. David Smith, Western Illinois University; Terry Lindenberg, Rock Valley College
Indiana—Paul Parkison, Ball State University
Iowa—Claire Smith, Iowa State University
Kansas—Donald Cash, Pittsburg State University
Kentucky—
Louisiana—Cynthia R. Bettinger, McNeese State University
Maine—Melvin T. McClure, University of Maine at Orono
Maryland—Vinod Thankappan, University of Baltimore
Massachusetts—Kenneth Schwartz, Boston College
Michigan—Joe Anthony, Michigan State University
Minnesota—John Lere, St. Cloud State University
Mississippi—Dale Flesher, University of Mississippi
Missouri—Ken Harmon and Kaye Poston, University of Missouri
Montana—Teresa Beed, University of Montana
Nebraska—Donna Redinbaugh, Creighton University
Nevada—Glenn A. Vent, University of Nevada at Las Vegas
New Hampshire—Judith N. Bouley, University of New Hampshire
New Jersey—Larry Prober, Rutgers University-Camden
New Mexico—Arley A. Howard, University of New Mexico
New York—Bernard H. Newman, Pace University; Donald F. Arnold, Union College
North Carolina—Robert E. Guinn, University of North Carolina at Charlotte
North Dakota—Arthur Hiltner, University of North Dakota
Ohio—Bhanu Raghunathan, University of Toledo
Oklahoma—Fred E. Sellers, University of Tulsa
Oregon—Rosanne M. Mohr, Portland State University
Pennsylvania—Heibatollah Sami, Temple University
Rhode Island—David Humphreys, University of Rhode Island
South Carolina—John S. Herin, University of South Carolina
South Dakota—Steven K. Olson, University of South Dakota
Tennessee—G. A. Swanson, Tennessee Technological University
Texas—Ruth H. Bullard, University of Texas at San Antonio; Otto H. Chang, Texas Christian University
Utah—Dave N. Stewart, Brigham Young University
Vermont—Peter E. Battelle, University of Vermont
Virginia—E. Richard Brownlee, University of Virginia
Washington—Gim Seow, University of Washington
Washington, D.C.—Joseph Hilmy, The George Washington University
West Virginia—Robert S. Maust, West Virginia University
Wisconsin—Wesley Sampson, University of Wisconsin at LaCrosse; Lucretia Mattson, University of Wisconsin at Eau Claire
Wyoming—George McGrail, University of Wyoming
Canada—Moustafa F. Abdel-Magid, Simon Fraser University

NOMINATIONS COMMITTEE

Charge: To select a list of nominees to AAA offices for election by the membership in August 1987.

Chairman: Harold Q. Langenderfer, University of North Carolina at Chapel Hill
Robert E. Jensen, Trinity University
Barbara D. Merino, North Texas State University
Russell Petersen, University of Alabama
Doyle Z. Williams, University of Southern California
Jan R. Williams, University of Tennessee
Stephen A. Zeff, Rice University

NOTABLE CONTRIBUTIONS TO ACCOUNTING LITERATURE (Nominating Subcommittee)

Charge: To nominate to the AICPA-AAA Notable Contributions to Accounting Literature Committee up to five selected books and articles each from those identified by the Screening Group as potentially notable accounting literature. Each nomination should be accompanied by an explanatory discussion of why the work should be considered to be a notable contribution.

Chairman: C. Jevons Lee, University of Pennsylvania
Sidney Davidson, University of Chicago
Thomas L. Dickens, Clemson University
John Eichenseher, University of Wisconsin-Madison
Robert P. Magee, Northwestern University
Robert R. Sterling, University of Utah
Wilfred C. Uecker, Rice University

NOTABLE CONTRIBUTIONS TO ACCOUNTING LITERATURE AWARD COMMITTEE (Screening Subcommittee)

Charge: To identify works of exceptional merit from books and articles that meet the guidelines established by the Executive Committee.

Chairman: Rick Antle, Yale University
C. Derek Acland, Concordia University
M. E. Aiken, Victoria University of Wellington, New Zealand
Carl. W. Alberni, Manhattan College
Anthony R. Carbone, Massachusetts Bay Community College
John Christensen, Odense University, Denmark
A. Charles Clark, Ohio University
Ronald L. Clark, University of Georgia
Frank L. Clarke, The University of Sydney, Australia
D. Larry Crumbley, Texas A & M University
John Elliot, Cornell University
Amin A. Elmallah, California State University-Sacramento
Sidney Gray, University of Glasgow, Scotland
Philip J. Harmelink, University of New Orleans
Loyd C. Heath, University of Washington
Dora R. Herring, Mississippi State University
Margaret Hicks, George Mason University
Ronald J. Huefner, SUNY at Buffalo
Larry Huus, University of Minnesota-Crookston
Orace E. Johnson, University of Illinois
Stuart Keller, University of Kentucky
Valerie C. Milliron, Penn State University
Richard J. Murdock, Ohio State University
Edmund Outslay, Michigan State University
John R. Page, Tulane University
Zoe-Vonna Palmrose, University of California-Berkeley
R. H. Parker, University of Exeter, England
Alan Reinstein, Oakland University
Robert W. Rouse, Clemson University
S. Sam Sedki, St. Mary's University
Philip H. Siegel, San Francisco State University
Karin Skadden, University of North Carolina at Chapel Hill
Susan A. Spataro, Ohio University
Wayne T. Stephens, Deloitte Haskins & Sells, Fort Worth
Clyde P. Stickney, Dartmouth College
Linda M. Stillabower, Case Western Reserve University
Don J. Summa, Rutgers University
Cyril Tomkins, University of Bath, England
Relmond P. Van Daniker, University of Kentucky
Ron Weber, University of Queensland, Australia
Geoffrey Whittington, University of Bristol, England
Charles J. Woelfel, University of North Carolina at Greensboro
Roland M. Wright, Southern Illinois University
Frederick H. Wu, Southern Illinois University
S. David Young, Tulane University

OPERATIONAL REVIEW TASK FORCE

Charge: To undertake an operational review of selected Association activities and practices and recommend to the Executive Committee any changes which the Committee believes might improve the effectiveness of the organization.

Chairman: Charles H. Smith, University of Illinois
Alvin A. Arens, Michigan State University
Charles T. Horngren, Stanford University
Robert S. Kay, Touche Ross & Co., New York
G. Fred Streuling, Brigham Young University
Gary E. White, Texas Tech University

PEAT, MARWICK, MITCHELL AUDITING PRACTICE AND RESEARCH SEMINARS COMMITTEE

Charge: To assist Peat, Marwick, Mitchell & Co. in the conduct of the auditing seminar series.

Chairman: Gary L. Holstrum, University of Southern California
D. Dewey Ward, Michigan State University

PROFESSIONAL EXAMINATIONS COMMITTEE

Charge: 1. To evaluate the appropriateness of the CPA and other licensing examinations to determine whether any of the examinations should be changed, either as to content coverage or level of difficulty, or both, as a vehicle for influencing accounting education. The committee is encouraged to identify and elaborate on specific examples of needed changes.

2. To elicit questions and problems together with solutions from members for use in licensing and other accounting certification examinations.

3. To monitor closely the work of the AICPA Task Force on Content Validity and keep the Executive Committee informed on any actions taken by that group.

4. To conduct a survey of research done in testing and summarize what is currently known about examination validation.

Chairman: Leonard M. Savoie, University of Notre Dame
Robert G. Bowman, University of Oregon
James D. Blum, AICPA
James S. DiStasio, Ernst & Whinney, Cleveland
Anthony T. Krzystofik, University of Massachusetts
Neil J. Miotto, Peat, Marwick, Mitchell & Co., New York
Thomas E. Powell, Institute of Internal Auditors
Karl E. Reichardt, Institute of Certified Management Accountants
Donald H. Skadden, University of Michigan
Charles W. Taylor, University of Mississippi

PROFESSORIAL ENVIRONMENT COMMITTEE

Charge: To document, in as much detail as possible, how the professorial environment of the accounting professor has changed during the past 25 years so that we might better anticipate the significance of these factors on the near-term implementation issues inherent in the 1986 (AAA) Report of the Committee on the Future Structure, Content, and Scope of Accounting Education.

Chairman: Joseph J. Schultz, Arizona State University
David R. Campbell, Case Western Reserve University
Charles G. Carpenter, Miami University
Don Dupont, Arthur Andersen & Co., Chicago
W. Thomas Lin, University of Southern California
Douglas A. Snowball, University of Florida
Shyam Sunder, University of Minnesota
Jane T. Rubin, AACSB
Miklos A. Vasarhelyi, Columbia University

PROGRAM ADVISORY COMMITTEE

Charge: To assist the President of the Association in developing the technical program for the 1987 annual meeting.

Chairman: John L. Kramer, University of Florida
Dhia D. AlHashim, California State University-Northridge
Shahid Ansari, California State University-Northridge
Stanley Baiman, Carnegie-Mellon University
Victor L. Bernard, University of Michigan
Edward J. Blocher, University of North Carolina at Chapel Hill
Daniel W. Collins, University of Iowa
George J. Foster, Stanford University
Graham Gal, University of Massachusetts
John G. Helmkamp, Indiana University
Betty R. Jackson, University of Colorado at Boulder
Prem C. Jain, University of Pennsylvania
Jack E. Kiger, University of Tennessee
Joseph A. Kreutle, Miami-Dade Community College
Michael W. Maher, University of Chicago
Charles L. McDonald, University of Florida
Kenneth Merchant, Harvard University
Barbara D. Merino, North Texas State University
Richard W. Metcalf, University of Nebraska
Marilyn Neimark, Baruch College—CUNY
D. Paul Newman, University of Texas at Austin
James M. Patton, University of Pittsburgh
Ronald H. Rasch, University of Florida

PUBLICATIONS COMMITTEE

Charge: 1. To study and report to the President and Executive Committee on all matters of concern in the field of publications.

2. To provide for the guidance of the Nominating Committee a slate of candidates for editors and editors-elect of *The Accounting Review, Accounting Horizons,* and *Issues in Accounting Education.*

Chairman: Robert T. Sprouse (1987), FASB (retired)
Thomas J. Burns (1988), Ohio State University
Eugene E. Comiskey (1988), Georgia Institute of Technology
Michael H. Granof, Chairman (1989), University of Texas
Jack L. Krogstad (1987), National Commission on Fraudulent Financial Reporting
D. Gerald Searfoss (1989), Touche Ross & Co., New York
John K. Simmons (1987), University of Florida

RESEARCH ADVISORY COMMITTEE

Charge: 1. To advise the Director of Research in the development and administration of the Association's program in accounting research.

2. To suggest ways to encourage research in accounting, especially research which interfaces with the accountant's role in business.

Chairman: Barry E. Cushing, Penn State University
Ronald Hilton, Cornell University
Lauren Kelly, University of Washington
Lawrence A. Tomassini, University of Texas at Austin
Paul R. Watkins, University of Southern California
Mark A. Wolfson, Stanford University

SECURITIES AND EXCHANGE COMMISSION LIAISON COMMITTEE

Charge: 1. To determine what aspects of SEC accounting are included in the accounting curricula of appropriate colleges and universities.

2. To make recommendations as to what SEC processes and pronouncements should be included in designated accounting curricula, including the identification of ways of implementing SEC topics into specified curricula.

3. To continue to develop and implement means for providing input and assistance to the SEC by academic accountants.

Chairman: Jimmy W. Martin, University of Montevallo
Robert K. Eskew, Purdue University
J. Edward Ketz, Penn State University
Larry M. Parker, Case Western Reserve University
John H. Smith, University of Iowa

STUDENT FELLOWSHIPS COMMITTEE

Charge: To select the 1986-87 recipients of American Accounting Association grants and determine the amounts of their awards.

Chairman: James Deitrick, University of Texas at Austin
John M. Hassell, Florida State University
Talmadge C. Tillman, Jr., California State University-Long Beach

TRUEBLOOD SEMINARS COMMITTEE

Charge: To assist Touche Ross & Co. in planning and conducting the Trueblood Seminars, which are staffed and funded by Touche Ross & Co.

Chairman: P. David Shields, Rice University
Lauren Kelly, University of Washington
Richard E. Ziegler, University of Illinois

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BOOK REVIEWS

Harvey S. Hendrickson, Editor

EDITOR'S NOTE: Books for review should be sent to Professor Richard P. Brief, 520 Tisch Hall, College of Business and Public Administration, New York University, New York, NY 10003.

(The policy of the *Review* is to publish only those reviews solicited by the Book Review Editor. Unsolicited reviews will not be accepted.)

AHMED BELKAOUI, *The Learning Curve: A Management Accounting Tool* (Westport, CT: Quorum Books, 1986, pp. xiii, 245, $39.95).

The preface introduces the organization of this book and promises explanation and elaboration on history and geometries of the learning curve, techniques of using the log-linear model, practical applications, possible limitations, and methods of implementation.

After a definition and brief history of the development of the learning curve, six competing models are introduced and compared to the popular log-linear model. Three forms of the log-linear model (the average time model, the marginal time model, and the individual unit-time model) are presented with detail on how to calculate individual unit time, total time, marginal time, and average time for each form. While this is important material, deciding which model to use perhaps is most important. But this subject is covered in 16 lines that end with the statement that the model with the highest coefficient of determination has the best fit and "should be used as the right model for the observed learning phenomenon" (p. 40).

The decision is more complex than that. Care must be taken to detect a possible parametric shift due, for example, to the learning process reaching a plateau. Expected costs of estimation errors also must be considered.

This section is troublesome because of numerous, significant errors in text, notation, and graphs. Though remediable if the sophisticated reader works carefully through the mathematics, these errors are distracting and diminish confidence in the work.

Chapter 3 would be improved if all material on estimation of learning models from empirical data were under a separate heading. Another shortcoming is that greater coverage is needed of model estimation from empirical data. The newcomer would benefit from a more complete summary of the literature on regression analysis in the presence of learning.

The section on applications ranges from accounting concerns like break-even analysis to warranty maintenance and work-accident experience. It is both clear and concise. The treatment of standard costs and efficiency variance analysis under learning is thin for a book with managerial accounting emphasis and should reference relevant literature.

The final chapter covers what is not known and errors commonly made in applying learning curves. This is a reasonable conclusion because it reminds the reader to be cautious in working with the models revealed earlier.

The book has very little text (about 50 pages) and many tables. Most, including five pages of logarithms and a 148-page appendix with computed values of X^b, should be removed since they represent simple calculator computations. The scope is broad so that the treatment of any given topic tends to be sparse. The book has elements of a good topic overview if the reader can stay on track through the errors and uneven writing. References and notes are extensive, and most high points of the literature appear to be referenced.

The book could be helpful as an integrative work for use with other sources. It contains an extensive bibliography and so could be useful to the researcher and seasoned practitioner. It falls short for the unseasoned student and practitioner. It has too many distractions, and the "how to" parts end short of being helpful guides to application. A work of this kind has been needed to synthesize the literature. If Professor Belkaoui significantly expands the text and corrects its errors, the second edition could become a valuable resource.

David W. Harvey
Associate Professor of Accounting
Tulane University

Leopold A. Bernstein and Mostafa M. Maksy, *Cases in Financial Statement Reporting and Analysis* (Homewood: Richard D. Irwin, Inc., 1986, $17.95 paper).

Teaching financial statement analysis can take one or more of several approaches. At one extreme, most financial accounting texts present one chapter on ratios. At the other extreme, finance texts often treat financial statement analysis as part of investment analysis. Statement analysis is much more than either of these extremes. It is the responsibility of a securities analyst concerned about why a company's financial statements have changed, the responsibility of a financial planner involved in preparation of short- and long-term forecasts, and the responsibility of a bank officer expected to evaluate a corporate loan application.

Knowledge of financial statement analysis involves an understanding of tools and techniques coupled with analytical skills. An appreciation of the material comes only with practice using a variety of financial reports using different types of analysis.

This text is divided into four sections—a model case followed by three parts containing actual cases and assignments. The model case is a thorough 69-page application and discussion of a variety of analytical tools to a single set of financial statements. Part 1 contains three introductory cases that focus on financial statement interrelationships. These provide a good review of the accounting skills needed for financial statement analysis (FSA).

Part 2, the main portion of the text, contains ten cases that focus on selected topics and FSA techniques. Each case contains a number of questions and sub-questions that require analysis of balance-sheet, income-statement, or statement-of-changes-in-financial-position accounts. Specific questions about a variety of analysis techniques are included in many cases. These techniques include evaluation of financial ratios, assessment of credit worthiness or bankruptcy prediction, and operational analysis with common-size or trend analysis.

Because learning FSA requires practice, it is useful to assign only a few questions from each individual case as different topics are discussed in the course. Since several cases have sets of similar questions, students receive the needed practice with analytical issues and with examination of a variety of financial reports. The later cases include relatively more "analytical technique" questions and fewer accounting questions.

Part 3 contains five comprehensive cases that include a very complete set of accounting and FSA questions. While the Part 2 cases are useful for weekly assignments, using the Part 3 cases as part of a group project worked well.

This text is very good as a case-oriented supplement for an advanced undergraduate or graduate course in financial statement analysis. But some of the questions in each case are time-consuming and require judgments by the students. To avoid having the students feel they are expending an unnecessary amount of time and getting "wrong" answers, the instructor should go over the questions and suggested solutions before students begin these assignments with the idea of providing hints. The accompanying solutions manual is quite good, although some of the suggested solutions are not the only possibility and may not coincide with those of the instructor or students.

The flaw in this text is its obvious linkages to the Bernstein *Financial Statement Analysis* text (Third Edition, Irwin, 1983) in the "analytical techniques" suggested in the questions. The methods applied are very traditional and little time is spent on company valuation issues or merger or acquisition problems. Coverage of these methods would broaden the audience for this otherwise very good text.

James G. Manegold
Associate Professor of Accounting
University of Southern California

Gordon L. Duke, Robert A. Leitch, and John Neter, *Behavior of Test Statistics in the Auditing Environment: An Empirical Study*, Studies in Accounting Research No. 23 (Sarasota: American Accounting Association, 1985, pp. viii, 178, $12.00 paper).

Users and abusers of statistical sampling techniques still remain who don't know that applying a "statistical" sampling technique does not by itself guarantee accurate sampling conclusions. When statistical techniques are applied, art and science come together in matching the appropriate techniques to the specific application situation. This research advances the science associated with decisions to apply statistical sampling techniques, and takes its place as a part of the literature, now decades old, that cautions auditors (and others) to carefully match statistical audit techniques to the circumstances of application.

The study is an expansion of Gordon Duke's 1980 doctoral thesis, which was summarized in the Spring 1982 issue of the *Journal of Accounting Research* (pp. 42-67). It reports the results of a massive simulation of the performance of eight statistical techniques in a variety of plausible audit situations (e.g., various error rates and error distributions). The authors expand on Duke's work by:

- Adding the concept of materiality (a critical practical reality) to the research design.
- Adding some limited results of tests of the multinomial and cell method dollar-unit sampling techniques.
- Evaluating the effect of various population characteristics on the power of the test.
- Considering the effect of Bayesian prior information on the measured sampling risk.

The techniques studied include some that are used frequently in practice, such as the stratified difference estimator, and some that are relatively unknown in practice but are suggested in the literature, such as the "dollar-unit sampling augmented variance mean-per-unit test procedure" suggested by Howard L. Jones in a 1976 working paper. The reader is left to distinguish between those techniques that are commonly used and those that are not. The major conclusion of the study is consistent with prior research: no one statistical technique is superior in all situations.

An excellent chapter of the monograph cites many of the previous theory and simulation studies in the area of classical and dollar-unit sampling. Following that is a concise discussion of the terminology and the methodology used in the study. The authors correctly lament the lack of standard terminology, which plagues readers of the research in this area. The material on terminology and methodology may be insufficient by itself to make the statistical principles clear to novices, but it does an excellent job of communicating the authors' thoughts to those who are more knowledgeable about the subject. More casual readers may choose to focus on Chapter 9, Summary and Conclusions, for which a less detailed study of the methodology and terminology is required.

The presentation is scholarly and concise. Readers will not confuse this work with light reading. Stuffed into 178 pages are over 100 pages of tables, figures, and graphs from which the text is derived. But the body of the research might be too "clinical" for those attempting to read it at one sitting.

Serious students and researchers of statistical applications will find this study worthy of review. Practitioners, particularly policy makers with a background in statistical principles, may be able to use the study to further refine decision rules that guide field auditors to an appropriate statistical technique for the field situation (or at least to avoid a technique that is likely to be inappropriate). Those involved in special situation engagements (e.g., cost-reimbursement audits, tax audits, litigation support, and regulatory compliance engagements) also will find the study results helpful. This is because for those engagements, sampling information is often the primary source of audit assurance, whereas for many standard auditing situations, a great deal of corroborating and supplemental information is available in addition to sampling information. Thus, for those special engagements the dependability of the statistical technique takes on increased importance.

The study confirms some of the key findings of previous studies (e.g., Neter and Loebbecke, *Behavior of Major Statistical Estimators in Sampling Accounting Populations—An Empirical Study*, AICPA, 1975), namely:

- No one statistical method is best for all circumstances.
- Statistical samples of, say, 100 items do not necessarily lead to reliable results, perhaps due to the inappropriateness of large-sample theory.
- Stratification is valuable.

The authors overstate the current role of statistical sampling in auditing. Nonstatistical techniques presently are dominant in audit practice and are likely to remain so for some time. But a number of firms have focused attention on either one or a few statistical techniques for general audit or special situation purposes, and this study could be useful in corroborating that the statistical techniques they have selected are adequate to meet practice needs.

The study acknowledges, but does not emphasize, the impracticability of the field auditor's ascertaining all the relevant population and error distribution characteristics prior to audit testing. The practical implication of this is that auditors need statistical techniques that will be dependable under a variety of possible field conditions. Statistical sampling research should focus on helping auditors narrow the field of statistical techniques, and the techniques that are demonstrated to be inferior in performance when compared to others should be eliminated from active research. This study will help practitioners narrow the field of choice, particularly in eliminating the less well-known techniques that had some appeal in theory, but did not test well.

The authors also offer a glimpse of some practical future research studies in this area. The accounting profession apparently will see more research on the effect of Bayesian priors on sample performance. Also, the study gives limited simulation data for the cell method dollar-unit sampling technique (a technique significantly used by at least one firm) and does not address the ratio estimator, a technique commonly used in practice. While there remains work to be done, this study furthers our understanding of the practical considerations in applying statistical techniques in practice.

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ERIC G. FLAMHOLTZ, MICHAEL A. DIAMOND, and DIANA TROIK FLAMHOLTZ, *Financial Accounting* (New York: Macmillan Publishing Co., 1986, p. xxxiii, 758, $33.75).

New introductory financial accounting texts are being published with great frequency. One may therefore question if these new publications make a genuine contribution to the field. This book does because of its balanced blend of theory and practice and because of its emphasis on using accounting information in decision making. The text is clearly written and very readable. Students should have no difficulty in understanding the authors' presentation.

The book consists of 18 chapters. No attempt was made to organize these chapters into two or more coherent sections, although the introduction and discussion of topics, for the most part, do follow a fairly logical sequence. The chapters themselves provide a conceptual, comprehensive introduction to the topic of financial accounting with emphasis on measurement and reporting. The mechanics of the accounting process are adequately covered, but not to the extent that the user focuses solely on the mechanics.

Each chapter begins with a list of learning objectives so that the reader is made aware of what (s)he is expected to derive from the chapter. Generally subjects are well introduced and clearly explained. Examples and illustrations are given to supplement the discussion. A number of these illustrations are drawn from actual annual reports. The end-of-chapter materials relate well to the concepts presented and provide a variety of questions, exercises, and problems in addition to a summary of the learning objectives and a list of the key terms.

A complete package of support materials is available. For the instructor it includes an instructor's manual; a solution manual; a test bank that also is available on Macmillan's computerized testing system, Micro Test, or in IBM-PC, APPLE, or TRS-80 formats; transparencies; and a checklist of key figures. For the student it includes a study guide, working papers, a manual practice set, and a very interesting computerized accounting simulation in which students can use "What-if" questions to see the effect of various changes.

The coverage is standard, starting with the accounting cycle, followed by separate chapters on the major asset, liability, and equity accounts, and finishing with specialized topics—in this case, accounting for changing prices and problems of multinational corporations, statement of changes in financial position, and interpreting financial statements data.

The first five chapters, which cover the framework of financial accounting and the accounting cycle, are easily among the finest introductions to accounting. Despite the relative intricacy of the material, it is presented with clarity, in nontechnical language, and without bookkeeping notation. A student who reads no more than these first five chapters will gain a considerable appreciation of what accounting is all about.

Chapter 6, which introduces the accounts required in a merchandising firm, is short but concise. The procedures for processing data through special journals and subsidiary ledgers are discussed in Chapter 7. Also in this chapter is an excellent section on internal control and the role of computers.

Assets, liabilities, and their effect on income are discussed in Chapters 8 through 12. One of the high points of this section is the discussion of income tax allocation and lease accounting. Both long- and short-term investments in equity securities are covered in one chapter (Chapter 15). This probably is a more efficient way of covering these subjects than the separate treatment given them in most texts.

A quite extensive discussion of owners' equity is provided in Chapters 13 and 14, and the treatment of accounting for changing prices and problems related to multinational corporations (Chapter 16) is more exhaustive than normally found in a basic text. Both cash-based and working capital-based statements of changes in financial position are introduced in Chapter 17.

Emphasis throughout all these chapters is placed on the understanding and interpretation of financial statements. Ratio analysis is utilized in conjunction with individual topics in the different chapters. A complete summary of the tools of financial analysis is contained in the final chapter (Chapter 18).

As usual, the text contains more material than can be covered comfortably in one semester.

The outstanding features of the text are its flexibility and its emphasis on the use of accounting information in addition to the techniques of accounting and reporting. The authors' emphasis on flexibility is evident in their placement in appendices of materials that relate to detailed procedures and mechanics, such as accounting for unincorporated business and for payroll and the voucher system.

The text is not without flaws. The authors completely ignore the discussion of some important subjects such as LIFO inventory costing using perpetual procedures, recovery of accounts written-off, cash compensating balances, and pension accounting. Also, the section on the role of computers (Chapter 6) is not sufficiently broad in its coverage.

In summary, this book together with the support materials is an excellent introductory text with the flexibility to be used in undergraduate or graduate courses with emphasis on concepts or on both concepts and procedures of accounting.

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RONALD W. HILTON, *Probabilistic Choice Models and Information*, Studies in Accounting Research No. 24 (Sarasota: American Accounting Association, 1985, pp. 194, $15.00 paper).

Until the publication of this monograph, the information economics literature in accounting restricted attention to behavior that allows representation by expected utility maximization (EUM). A good reason can be advanced for this focus: the EUM model is grounded in hundreds of years of analytical and empirical investigation. On the analytical side, the limitations on preferences that admit EUM representation have been thoroughly explored. However, it is well-known that the EUM model has failed many (most?) of its empirical hurdles. As a consequence, choice theorists have developed a number of alternative models of behavior, including models that represent behavior in a probabilistic way. These models are called probabilistic choice models (PCMs), and their introduction to the accounting literature and extension to information system choice are the purposes of this monograph.

These are certainly worthwhile goals, and I believe the monograph represents a good start in the area. Three types of PCMs are introduced, and necessary and sufficient conditions for choice to be represented by the models are explored (although complete characterizations for all models are not available). The issues involved in extending the models to information choice are discussed, and extensions are presented. Finally, the basic result of information economics, Blackwell's theorem on fineness, is explored in the extended models. This is an excellent structure; the only significant omission is a section relating PCMs to the other alternatives to improving EUM models (e.g., Machina, "'Expected Utility' Analysis Without the Independence Axiom," *Econometrica*, March 1982, pp. 277-323).

My *caveats* about the monograph relate to the models and their extensions to information system choice. To avoid being subject to the same empirical objections as the EUM model, PCMs impose weaker restrictions on behavior. Such models are harder to falsify because the necessary conditions for them to hold are less stringent. Correspondingly, they provide weaker implications. For example, Blackwell's theorem fails to generalize to some of the PCMs.

It is claimed that probabilistic choice may result from some form of bounded rationality, but the models presented are a partial step towards better modeling of the choices of decision makers with bounded rationality. What is missing is intelligent coping with bounded rationality; the decision maker's recognition of limitations and application of intelligence to overcome them. These considerations are suppressed in the

PCMs presented in the monograph.

Also, the extensions of the models to information system choice are *ad hoc.* The extensions apply the notion of "choice domain consistency," which asserts that the model used to describe information choice should be the same as the model used to describe the final action choice. While this concept seems reasonable, it does not imply a unique extension of the choice model to the choice of information system alternatives. The extensions presented are intuitive, but they are not well grounded, either axiomatically or empirically.

A final concern relates to the treatment of two-person situations, in which an information evaluator selects an information system and a decision maker selects an action. The analysis of two-person issues is weaker than the rest, primarily because the game-theoretic foundations of the two-person analysis are not presented.

But the fact remains that the monograph accomplishes its objectives and does them well. The presentation style should make the monograph widely accessible. The level of mathematics required is not deep (essentially just the ability to tolerate mathematical notation), and numerous examples are given. Few proofs are presented and those that are rely on basic concepts. This also is a limitation; those interested in the technical side of the subject will have to look elsewhere.

The level and style of the monograph make it most appropriate for a somewhat seasoned researcher, especially since the focus is on choice models and the tie to accounting issues is indirect. I recommend this book to those with an interest in PCMs and their application to information analysis.

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Vernon Kam, *Accounting Theory* (New York: John Wiley & Sons, 1986, pp. xv, 416, $33.95).

In writing a book on accounting theory, decisions must be made both about the approach to the subject and the level of difficulty of the content. The preface accurately describes the nature of this book on both of these dimensions.

The author states an intention to blend "low level" and "high level" theory. As defined by the author, "[t]he former consists mainly of the very basic concepts, such as those found in Intermediate Accounting, and the pronouncements of authoritative bodies. . . . High level theory usually concerns procedures that are currently not used in practice or a deeper analysis of present concepts and standards" (p. vii).

The blending of "high" and "low" level theory is achieved consistently throughout the book. It is achieved with particular success in the chapter on revenue and recognition where authoritative pronouncements on specific revenue areas are discussed together with general revenue recognition issues.

Questions are included at the end of each chapter and many chapters also have a few problems. The questions focus primarily on theoretical dimensions but generally are not complex. Most problems require journal entries and are similar to those found in intermediate accounting. This is not surprising since the author explains in the preface his purpose for including these types of problems. Whether such problems strengthen or weaken a book on accounting theory is debatable. But this clearly is not the overall level and orientation of the book. Significant discussions of important theoretical issues are included in the text material and differentiate this book from several others which are more practice or CPA-review-oriented.

Other theory books that currently are available fall on either side in the level of difficulty and the blend of "high" and "low" theory. While *Accounting Theory* emphasizes breadth more than depth in its coverage of complex theoretical issues, it lives up to the title in both scope and depth. The book would be appropriate for use in either a senior or graduate-level accounting theory class. Users of the book may want to require selected readings or other supplemental materials to augment some of the chapters, particularly for a graduate-level theory course. Additional materials that might be appropriate range from detailed information about the FASB Conceptual Framework to more detailed discussions of various asset valuation and income measurement models.

Unlike some accounting theory books, little discussion is included on the application of accounting theory to individual areas such as inventories; property, plant, and equipment; and intangibles. Consequently, specific topics like depreciation, human resources, goodwill, and potential or questionable liabilities receive little or no detailed attention. Coverage of the measurement and reporting of specific assets and liabilities and their particular decision-usefulness for various users would require the use of supplemental material.

Research in accounting is not systematically addressed, although specific research studies are cited either as examples or in support of appropriate sections. Graduate courses that focus on research and/or the current research literature might find selected chapters useful for an overview, but would need to rely primarily on other materials. Similarly, a research segment of a general theory course would require additional materials as assigned reading.

The overall organization of *Accounting Theory* is logical and it generally reads smoothly. The author recognizes the most obvious question about chapter organization in the preface. Specifically, the last four chapters primarily address issues and approaches to developing accounting theory, including the setting of standards in a political environment. An instructor may wish to address these topics early in a course on accounting theory and the author states that this is an alternative that can be followed without loss of continuity.

In summary, this book achieves the stated intentions of the author. It has a blend of "high" and "low" level theory and is particularly suited for a theory course that does not focus at either end of that potential continuum. Persons interested in teaching accounting theory should find it a welcome addition to the available materials.

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TONY LOWE and JOHN L. J. MACHIN, Editors, *New Perspectives in Management Control* (New York: St. Martin's Press, 1983, pp. xiii, 318, $30.00; also available from London: Macmillan Publishers, £27.50).

The academic community in North America is fortunate to have this group of essays from the U.K. where scholarship (much of it not included in mainstream publications) in the area of management control systems is more advanced. The editors, who are also major contributors, have put together an outstanding collection of essays, all of which were commissioned for this book. With increased interest in this topic in North America, serious students and researchers will find this to be a valuable if not essential addition to further effort in the area. Major focuses of the writings are on theories of management control systems, research methods appropriate for the topic, the contribution of other disciplines to the study of the area, and analyses of past research efforts in the area. Rather than present a unified viewpoint, the essays point out critical differences in approaches and viewpoints. The authors reviewed each other's submissions to sharpen and clarify the points of difference without becoming contentious but maintaining a coherent sense of purpose.

Significant recurring themes are that the accounting discipline has made the most significant early contribution to management control system thought, notably in writings of such stalwarts as Bob Anthony and Ed Caplan. Management control, however, is neither synonymous with nor an extension of management accounting. Traditional management accounting measurements that are based on normative economic models are value-laden and lack empirical validity. In addition, traditional management accounting thought that separates management control from the goal formulation and strategic planning processes is artificial and inappropriate. The authors note a shift in managerial emphasis from the efficient use of resources, the traditional management accounting focus, to goal formulation and organization effectiveness. But these areas are not well understood and have not been well integrated into the study of management control systems.

The major strength of the book is in the first seven chapters that deal with the purposes of management control systems, theories that might help understand these purposes, and research methods that may be fruitful in the further study of these purposes and in system design. The potential contribution of general systems theory and cybernetics to management control systems study is explored in some depth. In doing so, the writers draw extensively from such well-known organization theorists as Katz and Kahn and Cyert and March. Their writings, while classics in the field, are just now becoming integrated into the study of management control systems. The next six chapters deal with specific topic areas such as motivation, worker participation, and financial reporting. These chapters are very well done and make a contribution to the area, but they do not have quite as much impact as the others. A final chapter, which identifies areas of consensus and sets the topic of management control systems in the context of organizational effectiveness, concludes the work in the same vein as the first seven.

The book admirably meets its stated purpose to stimulate discussion about the study and practice of management control. It would be a worthy addition to the personal library of students and professors involved in the area and certainly belongs in the library of any university where the subject might be studied. Its classroom use would be limited to that of supplemental reading; it cannot substitute for a basic text in the area. It could serve as the basis for an advanced graduate-level seminar on management control systems, although such seminars are quite rare. Additionally, students would surely find the book useful as resource material for term papers in various courses, not just courses in management control systems.

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SHANE MORIARITY, Editor, *Laboratory Market Research* (Norman: The University of Oklahoma Center for Economic Research, 1986, pp. iv, 222, $15.00 paper).

This book contains the proceedings of a conference held at the University of Oklahoma in 1985. The volume includes the eight papers presented at the conference and an article on the development of market research in the laboratory. The objective of the conference was to focus on this new research method (p. iii). The topics examined are quite interesting, but would not fit a conventional definition of accounting.

Although the topics vary, they share some common themes; most pervasive is the role of information asymmetry. It is in most of the papers: in using sealed-bid auctions testing hypotheses about the "winner's curse"; in securities markets testing Morse's hypothesis of the different information signals conveyed by trade volume and prices (Lundholm); in regulatory processes attempting to induce a natural monopolist to price the product as if operating in a competitive market (Cox and Isaac); in integrating human information processing heuristics and economic incentives (Duh and Sunder); in markets where collusive behavior might exist (a paper by DeJong, Forsythe, and Schatzberg, and another by Block and Gerety); and in contracts between the experimenter and subjects in the laboratory (Eger and Kirby).

The lack of data from "naturally occurring markets" often is stated as the motivation for using market laboratory as a research method. It allows the researcher to generate data to test trading behavior under different regimes of trading suspension rules (Coursey and Dyl); to examine the effects of different incentive systems (e.g., the papers by Duh and Sunder, Cox and Isaac, Eger and Kirby, and Block and Gerety); or to study basic propositions related to whether humans are Bayesian processors of information (e.g., Duh and Sunder, and Jenkins).

A third common theme is the concern for the internal validity of the reported experiments. Holt and Villamil's introductory paper warns that:

> Complicated environments may be difficult for subjects to understand and the subjects may become bored if the experiment becomes too long. Furthermore it may be too difficult or expensive to enforce non-communication among subjects over extended periods of time or between experimental sessions. . . . Most experiments last only 2 to 3 hours per session . . . (p. 11).

The discussants were consistent in raising internal validity questions (Waller, p. 34; Holt, p. 83; Heiner, p. 118; Dickhaut, p. 150; O'Brien, p. 169; Levine, p. 188, and all of Baiman's comments). This consistency might suggest the need for greater familiarity of the problems encountered and considered by other behavioral researchers. A wealth of information about these problems has been accumulated in other branches of the behavioral sciences and upon which researchers using the market laboratory methods can build. For example, the literature on experimentation has shown that a two- to three-hour limit on a laboratory session creates difficult problems with consequences for the internal validity of experiments. With the exception of the paper by Duh and Sunder, little integration of the different behavioral approaches is noted. Indeed, the discussants do a better job in this respect (I particularly enjoyed the discussion comments by Dickhaut).

Both the main articles and the discussants' papers contribute to this objective. The discussants' comments generally were constructive, although the many questions that Baiman has raised ended the book on a somewhat down note. The positive contribution of the collective efforts of authors and discussants could have been highlighted by providing a "synthesis" at the end of the book.

In general, this book has achieved its objective of introducing the readers to this new research method. I recommend it for those who would like to learn about market experimentation as a research method.

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BELVERD E. NEEDLES, JR., Editor, *Comparative International Auditing Standards* (Sarasota: American Accounting Association, 1985, pp. ix, 193, $12.00 paper).

This publication's clear and stated intent is to encourage interest in international auditing education and research. The dominant issues addressed are the diversity of attitudes, status, and progress in auditing, and the setting of auditing standards throughout the world. Students of accounting and auditing with an interest in cross-cultural differences in accounting and auditing institutions will find this book worth acquiring.

To develop a workable framework, the editor includes ten separate pieces on the auditing standards-setting situation in selected countries within the geopolitical framework: Europe (four), the Middle East (two), Asia (one), and North America (three). While one's favorite countries might be overlooked in this process, the representation is quite sound. For example, Australia and New Zealand, among many other countries, are omitted. However, New Zealand tends to the institutions and structures of the United Kingdom, while Australia is an interesting mix of attitudes and institutions represented in the United Kingdom and the United States. Despite a generally sound selection of regions and countries, some discussion of omitted country characteristics would have been interesting and useful.

To enhance comparability across regions and countries, the authors of the ten pieces were asked to follow a standard outline addressing the topics: the auditor, the attest function, ethical standards and enforcement, independence, and the audit report. This decision is both the primary strength and the likely proximate cause of the primary weakness of the book.

The editor capitalizes effectively on the standardized organization of the individual pieces by providing the reader with an overview of the project which includes the extensive use of tables based on the standardized organization and obviously drawn from the information included in each of the ten separate country presentations. This chapter is well written and well worth reading in that it goes beyond simple summarization, introducing a degree of cross-cultural analysis and synthesis.

Unfortunately, with only a few exceptional insights, this same framework seems to have led to the creation of ten essentially dry, factual presentations whose primary contribution is in extending the more terse tabular presentations of the overview. The individual authors fail, or were cautioned to limit their efforts, to take the opportunity to provide any real insight into the psychological, economic, and political realities of auditing in these various regions. Tantalizing possibilities exist for investigating more closely the cultural psychology of the regions, their historic trade and political relationships over time, and how they relate to the current and likely state of domestic and international auditing standards. The Swiss penchant for secrecy in the banking community might have been pursued; the conviction and posture of French independence and the uniquely Arab mentality in business relations would have provided interesting reading and potential insights into both the potentialities and difficulties associated with the development of international auditing standards. Very little of this type of consideration is provided in the ten country presentations. A notable exception is found in the article on Japan, in which the author relates the mental structure of the Japanese character to the audit activity and discusses the cultural struggle that must be overcome to accept audits as something other than a personal affront. A very thoughtful analogy is drawn between the Japanese psyche and a raw egg without a shell. Perhaps the editor's desire to encourage interest and research will be served by this apparent weakness, because readers may be enticed to seek answers to the many questions left unanswered by this book.

While the authors provide readers with a wealth of factual material, the reader justifiably will feel that the story has considerably more than bare facts. In the overview the editor provides an answer to the rather narrow perspective adopted by the individual authors. He states quite clearly that the harmonization of international standards is considered a desirable condition to which the AAA International Section should contribute. This attitude may explain the rather delicate presentations made within the ten country articles. Perhaps the book's factual and somewhat political flavor represents an attempt to avoid subjective statements that might be thought by some to reflect badly on an individual country or upon the current processes intended to help produce harmonization. A further indication of this possibility is suggested by the editor's comments on the article following the overview and ten individual country presentations. This clearly suggests that the author of the latter article may be less positive than the editor.

This latter article sounds the first explicit note of discord in what to that point in the book might have appeared to be a steady movement toward international harmony in auditing standards. In that author's opinion, harmonization is not working and the reader gets the distinct impression that the author does not think that it ever will, at least not with the mechanisms currently used. This article is well worth reading, whatever your opinion on the international harmonization of auditing standards. The article can be criticized for its clearly ethnocentric orientation, but it provides a needed balance to the book and suggests a cautious and realistic view of the prospects of success in harmonizing international auditing standards. The editor was well advised to include it.

On the whole, this book is well worth reading. The editor's overview provides a clear summary of the ten country pieces, in part because the authors of these articles did a sound and workmanlike job of filling in the standardized outline. Most eclectic readers are likely to read only the overview and the critical comments in the next to the last article. These two items are likely to appear in future readings books that include a section on international auditing. For all but the truly committed, this will be enough.

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EPHRAIM P. SMITH, Coordinating Author, *CCH Federal Taxation: Advanced Topics*, 1986 Edition (Chicago: Commerce Clearing House, Inc., 1985, pp. xviii, 723, $33.00).

This book is volume two of a two-part set which is an introduction to federal taxation. It provides an in-depth study of the taxation of corporations, partnerships, S corporations, estates and gifts, and the income taxation of trusts and estates. It also introduces the concepts of tax research, planning, and administration and provides a comprehensive overview of tax law as it affects business entities. The text is appropriate for a second tax accounting course offered at the upper division or graduate level. The material, however, is too extensive to be covered adequately in a one-semester, three-credit course.

The book differs from other tax textbooks in that it is very concise and contains few explanatory charts, diagrams, or figures. Sample tax forms, when used, are imbedded in the text to review concepts and to illustrate tax compliance rather than in an appendix. Tax planning pointers, tax blunders, and comprehensive problems are included. Discussion questions, computational problems, and research questions accompany each chapter.

An overview of relevant tax law in an advanced topics textbook is unique and worthwhile. It provides the student with a quick review and an update of relevant tax law and lays the groundwork for concepts introduced later in the text.

The primary limitations are that concepts are not fully developed and explanations are unclear and inadequate. Many complex concepts are presented without an explanation of the application, purpose, or impact of the law. The examples are limited in number and those provided often are difficult to understand. The text also contains numerous errors. Many chapter questions do not relate to the concepts covered in the text, are beyond the ability level of the student, or are out-of-date given current tax law.

An instructor's manual, test bank, student study guide, and a booklet of facsimile tax return forms and problems accompany the book. The instructor's manual contains chapter summaries and answers to chapter questions and problems. The chapter summaries provide a very short, generalized overview of the chapter. No additional teaching aids, explanations, or materials are provided to compensate for the conciseness of the text. The solutions to chapter questions and problems often are unclear (i.e., determining how various answers were calculated is difficult because many numbers are not identified). Also, many solutions are presented either without a computational formula or with a formula consisting of numbers with no identifying labels. Answers often are incorrect or use out-of-date tax law. The test bank contains true/false and multiple-choice questions, many of which were adapted from the AICPA and IRS Special Enrollment examinations. The questions are limited in number. Although a student study guide is advertised to accompany the text, it was not available for the 1985-86 academic year and is not reviewed here. The tax form problems and filled-in forms book are comprehensive and helpful to the student. Again, they contain errors and some concepts are not adequately explained.

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ROSS L. WATTS and JEROLD L. ZIMMERMAN, *Positive Accounting Theory* (Englewood

Cliffs: Prentice-Hall, Inc., 1986, pp. xi, 388, $26.95).

This book, a recent addition to Prentice-Hall's Contemporary Topics in Accounting Series, reviews the theory and methodology of economics-based, empirical research in accounting. It is written for M.B.A. and Ph.D. students and assumes at least elementary knowledge of accounting, finance, microeconomics, statistics, and multiple regression analysis. This volume is thorough, clearly written, thought-provoking, and, like several other books in this highly successful series, certain to become more than just a useful graduate-level text.

In contrast to the "normative" approach that dominated accounting research through the 1960s, the authors promote a "positive" accounting theory that seeks to explain and predict accounting practice. Why, for example, do some firms use income-enhancing accounting methods while others use methods that reduce income? Why do some firms use "Big Eight" auditors and others do not?

Topics usually are introduced through extensive review of seminal articles. These articles then are used skillfully as springboards for discussing methodological controversies and subsequent research. The result is much more than a mere literature review describing the current state of research. Controversial areas of research are placed in their historical context; positive research is viewed as an evolutionary process and not simply a state of knowledge that exists at some point in time. For this reason, accounting researchers interested in research methodology and the philosophy of science, but who do not conduct research of this nature, may find the book instructive.

The book begins with discussions of the Efficient Market Hypothesis and the Capital Asset Pricing Model (CAPM) and their implications for empirical accounting research. Later chapters deal with the relationship between accounting earnings and stock prices, bankruptcy prediction, forecasting, disclosure regulation, accounting policy choice, and auditing. Although the emphasis is on financial reporting and market-based research, management accountants will benefit from two outstanding chapters on contracting and compensation. Of particular interest is the discussion contrasting the economic theory of agency with the financial view developed by Jensen and Meckling, and the implications of agency cost for accounting-based executive compensation contracts.

The book does have two minor weaknesses, but neither of these detracts seriously from its impressive strengths. First, readers might have benefitted if the book, which understandably relies almost exclusively on the CAPM as a valuation model, had given explicit recognition to the model's drawbacks—for example, nontestability and unexplained market phenomena such as the small-firm effect—and the implications of these drawbacks for research design.

A second weakness stems from the way the book treats criticism of positive research in general. Although methodological problems often are discussed in detail, the *broader* critiques of positive research in the economics literature (which have a bearing on positive *accounting* research) are largely ignored. Moreover, the book ignores pointed critiques of the Rochester School that have appeared recently in prominent accounting journals.

On balance, the book is one of the most important contributions to the accounting literature in recent years. Nowhere else can one find such a comprehensive and understandable treatment of the issues raised by positive accounting research. For this reason, the book is likely to become an indispensable reference guide for doctoral students and faculty members who conduct research in this area. It should be equally useful to others who wish to know more about this influential line of research.

M.B.A. students may find the detailed discussions of subtle methodological issues quite daunting. But for those instructors interested in stretching their students and providing them with the intellectual tools necessary to understand empirical accounting research, it deserves adoption consideration for accounting theory or policy courses.

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V. K. ZIMMERMAN, Editor, *Managerial Accounting: An Analysis of Current International Applications* (Urbana-Champaign: Center for International Education and Research in Accounting, University of Illinois, 1984, pp. v, 137, $8.00 paper).

In his introductory note, the editor states that international management accounting "has been largely neglected because of a primary concern with international accounting standards and reporting comparability" and that "[t]he critical importance of a managerial accountant's role in international trade today has been recognized" (p. v). The seminar papers included in this collection are intended to "help provide a basis to evaluate our international management accounting developments to date and the areas of increased importance awaiting attention by accountants" (p. v). Publications in this area are limited so this volume fills a critical need. While most of the seminar papers deal directly with managerial accounting issues, two deal with auditing (including internal auditing). Some critical issues in international managerial accounting are only casually mentioned. Many of the papers dealing with management accounting are minimally concerned with issues unique to multinationals. The practical tone and limited use of academic jargon make this book quite easy to read.

Of the nine papers, six are written by practitioners and three by professors. The general focus is on practice and actual corporate experiences. In three separate papers, the reader will find specific references to management and performance evaluation at Burroughs Corporation, corporate information flows at Caterpillar Tractor Company, and investment controls at International Finance Corporation. In most of the other papers, limited references are made to corporate experiences. Two papers (at the end of the volume) deal with general issues of management control and the managerial accountant's functions, one deals with the foreign currency issue in performance evaluation, and another deals with MIS issues for multinational corporations. The remaining two papers deal with auditing issues. Although the latter are only remotely related to the main theme, they are interesting and informative.

In a paper on international information systems, Neuhauser identifies MIS areas that are unique to multinationals: foreign currencies, inflation accounting, intercompany transfer pricing, performance evaluation criteria, and foreign country risks. A classification such as this could have identified the central topics of this emerging field of study.

Two major weaknesses are readily detectable. First, the papers are not organized in any apparent order. Perhaps this explains the inclusion of papers dealing with peripheral topics and the exclusion of some central topics such as inflation accounting and intercompany transfer pricing. Second, many of the papers dealing with the central issues of managerial accounting devote less space to the international aspects than to the basic, relatively well-developed concepts of management accounting. The first concern is understandable in the context of conference organization and the practical constraints of such an approach, while the second weakness can be explained by the fact that domestic and international management accounting issues largely overlap except in some of the areas mentioned in the above paragraph. Both concerns follow a pattern for slowly emerging new fields of study.

Although not intended for use as a textbook, this volume contains public references useful in the development of case material. It can also be used as a reference in advanced courses in international or management accounting. While it has only modestly achieved its aim, this publication adds to the rather limited publications in a critical area where more seems to be known than is articulated and published. It is a welcome addition to the reference library of practitioners, consultants, and educators of international management accounting.

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CAPSULE COMMENTARIES

Harvey S. Hendrickson, Editor

STEPHEN C. DIAMOND, Editor, *Leveraged Buyouts* (Homewood: Dow Jones-Irwin, 1985, pp. xv, 180, $40.00).

This compact book presents seven topical and three introductory/overview/issue papers by ten nonacademic authors (including the editor) whose backgrounds include accounting, corporate finance, investment banking, commercial banking, and law.

Although this is claimed in the preface and does appear to not be a "'how-to' textbook" (p. vii), it is a highly technical but inquiring and issue-oriented work that would be most useful as a reference in university and other libraries.

H.S.H.

THOMAS R. DYCKMAN and DALE MORSE, *Efficient Capital Markets and Accounting: A Critical Analysis*, Second Edition (Englewood Cliffs: Prentice-Hall, Inc., 1986, $20.95 paper).

The efficient market hypothesis (EMH) is an important element in understanding the role of financial reporting and the linkage of accounting information to the securities markets. This edition focuses on issues "of market efficiency and the testability of the EMH . . ." (p. xiv) rather than the procedural issues emphasized in the first edition (reviewed July 1976, pp. 693–694). An interesting dilemma is faced by authors who discuss a difficult research area in 129 pages. Should they aim at EMH researchers to enlighten them with a thorough review of the literature? Should they aim at non-EMH researchers or students to show them the breadth of EMH research and interest them in the area? Should they aim at professionals to teach them more about the EMH and what all the fuss is about? That the authors fail to adopt a coherent approach makes this book a disappointment.

The first chapter, which discusses the EMH and related models used in testing the theory, differs little from the first edition. Chapter two is new and appropriately identifies problems that have arisen in defining market efficiency. A useful addition to that chapter would have been a framework through which the literature review could be better appreciated.

The next chapters review tests of market efficiency using nonaccounting (Chapter 3) and accounting information (Chapter 4). A large amount of material is covered very quickly. On one hand, lack of an organizing framework, such as the procedural viewpoint in the first edition, makes the material very difficult for one not reasonably familiar with the EMH. On the other hand, without a more complete discussion of procedural issues and problems examined over the years, an experienced reader would find the presentation superficial. In the first edition, Chapters 2 and 3 review literature that supports or questions the EMH.

Chapter 5 deals with research that has found seeming inefficiencies in the market and tested pricing models usually used in EMH tests. Pricing-model adequacy and the related tests were more cogently discussed in the first edition. The market inefficiency discussion is not adequate for such an important (and difficult) topic.

The discussion of implications of the EMH for accounting in Chapter 6 is changed very little from that in Chapter 5 of the first edition. The two appendices dealing with mathematical constructs and a mathematical formulation of the EMH and related models are identical to the previous edition with the exception of a brief section on the Arbitrage Pricing Model.

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The Financial Desk Book (Emeryville, CA: Consolidated Group, Inc., 1985, pp. x, 779, $59.95).

This large handbook contains a wealth of data that the dust jacket claims are "the facts, figures, formulas, summaries, statistics, tables, and graphs most wanted by top financial advisors." More specifically, it includes sections on personal financial planning; taxation; major financial and economic indicators; rules, formulas, and tables for calculating yields and present and future values; rankings of major stock exchanges, funds, profit-sharing plan companies by industry, and publicly registered investment programs; professional development data primarily for the financial services area; a directory of national financial services organizations and the major federal government branches, agencies, commissions, and information centers; and a quick reference section that includes an extensive glossary. A substantial index also is included.

This volume contains many data that might be pursued often as trivia but occasionally as crucial to the completion of a manuscript, lecture, or speech; it would be a useful reference for accounting (and/or finance) school or departmental offices. Hopefully, the economics of currently available technology soon will eliminate the need for a volume such as this, so that academic and staff persons will be able to access a wide variety of data bases from their desktop computers.

H.S.H.

Charles H. Gibson and Patricia A. Frishkoff, *Cases in Financial Reporting*, Second Edition (Boston: Kent Publishing Co., 1985, pp. xvii, 413, $24.50).

This casebook is a collection of 120 cases, some taken directly from published financial statements and correspondence with regulatory bodies and others which are from articles and commentaries in business periodicals. The second edition is revised and expanded from the first (reviewed April 1982, pp. 442-443). Some of the cases "lend themselves to microcomputer solutions using spreadsheet analysis" (p. vii); these are identified in the table of contents and on page one of each case.

The cases are presented by topic in order of increasing difficulty in the application of financial reporting principles. They are arranged into 24 sections covering such diverse topics as bankruptcy, liquidation and reorganization, pensions, leases, foreign currency exchange, and nonprofit accounting. They range in length from one or two paragraphs to several pages. Each concludes with one or more exercise questions that require analysis or description of alternative treatments and probably would require additional research.

The authors suggest that the book can be used alone "as a text for students examining issues in financial reporting [or] in conjunction with readings or textbooks in intermediate accounting, accounting theory or contemporary issues" (p. viii). But the book probably could not stand alone as an undergraduate text because it lacks coverage of each topic area. The cases probably will be most valuable as supplementary assignments in accounting theory or contemporary issues in accounting.

Many of the cases are so brief that students may have difficulty understanding the questions asked at the end of the case (see cases 46 and 48, for example). Several of the cases also appear in the authors' book, *Financial Statement Analysis: Using Financial Information* (Third Edition, 1986).

Although I have reservations about the depth of coverage of the cases and the uses suggested by the authors, the book offers valuable supplementary material for accounting courses. The use of actual companies' published financial statement materials adds realism to otherwise theoretical concepts.

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Charles H. Gibson and Patricia A. Frishkoff, *Financial Statement Analysis: Using Financial Accounting Information*, Third Edition (Boston: Kent Publishing Co., 1986, pp. xviii, 696, $40.25).

This is an introductory text in financial statement analysis. The third edition is an expanded version of the second (reviewed January 1984, p. 146).

The text is organized so that basic principles of accounting and the balance sheet, income statement, and statement of retained earnings are reviewed before the introduction of analysis. A review of the statements of changes in financial position is delayed until Chapter 10, although much of the information is useful in the analysis developed in Chapters 6 through 9.

The coverage is extensive and includes references to many of the SEC's reporting requirements and pension plans (including ERISA but excluding any reference to current FASB discussions). The text has been expanded to include a chapter on personal financial statements and accounting for governments and other nonprofit institutions. A new company, Cooper Tire and Rubber Company, is used as an illustration of financial statement analysis in Chapter 5 and the Owens-Corning Fiberglas Corporation used in the second edition is included as an updated comprehensive case to conclude the book.

The use of examples taken from actual financial statements adds credibility to the examples and problems presented. These financial statements are used to provide the reader with an understanding of the end result of statement analysis.

The new chapter on Personal Financial Statements and Accounting for Governments and Other Nonprofit Institutions is a valuable addition. The section covering personal financial statements is essentially a recap of Statement of Position 82-1 published by the AICPA. The section on accounting for governments and other nonprofit institutions unfortunately includes a reference (p. 631) to financial statements that are not in accordance with GAAP (where the proceeds of debt are recorded as revenue). This section deals primarily with financial statements and offers very little useful information to the reader.

Although this text is introductory in nature, the user probably should have a background at least through intermediate financial accounting.

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CRAUFURD D. GOODWIN and MICHAEL NACHT, *Decline and Renewal: Causes and Cures of Decay among Foreign-Trained Intellectuals and Professionals in the Third World* (New York: Institute of International Education, 1986, pp. x, 75, free upon request).

This booklet is the ninth (the third by these authors) in a series of policy-oriented research reports that have been published by the IIE, which claims to be the largest U.S. higher educational exchange agency. The report focuses on the problem of Third World professionals not maintaining the competencies that they acquired in overseas study. It presents brief case studies of organizations and programs in the U.S. and in three less-developed countries (Mexico, Indonesia, and Turkey) that might be successful.

While the case study evidence is largely anecdotal, the report provides some useful insights, suggestions, and strategies that should be considered by universities and other organizations in the U.S. and developing nations interested in developing or maintaining exchange programs in education and research that will be successful on a continuing, long-term basis—both to the institutions and the persons involved.

H.S.H.

JOHN G. HELMKAMP, LEROY F. IMDIEKE, and RALPH E. SMITH, *Principles of Accounting*, Second Edition (New York: John Wiley & Sons, 1986, pp. xxi, 231, $33.95).

New features of this edition of the text are generally favorable (the first edition was reviewed October 1984, pp. 710–711). A brief description of the historical development of accounting initiates the opening chapter. Coverage of international accounting is expanded to nine pages which nicely capture the accounting essence of this increasingly important area in the chapter on long-term investments and consolidated financial statements.

Two other topics for which coverage differs significantly from the first edition are less clearly appropriate. The chapter on cost accumulation systems now contains both the FIFO and weighted average methods of accounting for beginning inventory costs under process costing procedures. The chapter on decision making and capital budgeting has 14 pages devoted to capital budgeting, in addition to a 13-page appendix on the time value of money. The obvious advantage of including topical presentation of this depth in a principles text is that discriminating users can readily delimit desired coverage. The authors provide three additional appendices for the voucher system, the perpetual inventory system, and specimen financial statements.

Routinely high quality, standard issue, supplementary materials are available for both instructor and student. The computerized practice set, while not glitch-free, is a good vehicle for giving all business students a modest hands-on computer experience at an early point in their programs. The computerized test bank provides over 1800 items (true-false, multiple choice, and completion questions, as well as exercises and problems). Users need know only how to turn on the computer. Designing and printing the examination is remarkably simple and fast. The software is called Microtest, and it is revolutionary.

On the other hand, current editions of a majority of accounting principles texts integrate learning objectives, for the most part, ineptly. This text is no exception. The learning objectives are not operationally defined, and the use of a hierarchical taxonomy (e.g., Gagne/Briggs) is not apparent.

This second edition is similar to its predecessor in that it has a procedural orientation. Distinguishing this volume from other competing volumes is difficult because the objectives of generating a procedural orientation are fairly obvious and common.

The perceived superiority of this text will no doubt be based on its comprehensiveness, including as it does all customary principles-level topics with well-organized presentations, a myriad of examples, pertinent exhibits, a variety of homework problems and cases, and a glossary. All of this is attractively packaged, well written, carefully edited, and without major flaw, except for the learning objectives. Although several close substitutes exist, no good reason can be given for not adopting this text if a conventional, procedural approach is considered suitable.

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WALTER G. KELL, WILLIAM C. BOYNTON, and RICHARD E. ZIEGLER, *Modern Auditing*, Third Edition (New York: John Wiley & Sons, 1986, pp. xviii, 823, $36.95).

This third edition of the former Kell and Ziegler auditing text adds William C. Boynton, former consulting editor, as a principal author. This review will emphasize changes in the current edition since previous editions have been reviewed (January 1981, pp. 220–222 and January 1985, pp. 160–161).

This edition continues most of the strong points of previous editions, including the earlier attempt to integrate EDP and statistical sampling concepts throughout the chapters. It also continues to present a first course in auditing and moves toward a "cycle approach" to financial statement auditing, although the substantive testing chapters retain a balance sheet orientation.

The book contains almost 20 percent more pages than the previous edition and this extra material considerably improves the text in three areas. Part I, Fundamental Relationships, expands from three to four chapters covering the nature of auditing, introduction to the auditor's report, standards related to accepting and planning an audit, and the general nature and documentation of audit evidence. The second area of expansion involves adding four to 12 multiple choice questions from professional examinations to the end of each chapter. Third, additional material has been added to cover new standards and the changing environment of auditing. Examples include recent standards on substantive tests prior to the balance sheet date, omitted procedures discovered after the report date, and special purpose internal accounting control reports. Expanded coverage of analytical review procedures and audits of micro- and minicomputers also is a welcome addition.

Of minor interest, objectives at the beginning of each chapter have been redesigned as *behavioral* objectives, shading has been used to highlight important points throughout the text, and spreadsheet printouts have replaced a number of manual working papers and illustrations. Finally, a cross-reference of the original SAS's to the codification of those standards is included on the inside cover of the text.

While the text, overall, can be recommended, several minor deficiencies persist in the current edition. First, as noted in a prior review, the book does not include references to additional bibliographic materials. Second, the probability-proportion-to-size section on sampling retains something of a "cookbook" approach. Third, the description of reporting on inconsistent application of GAAP somewhat incompletely covers the standards related to consistency and comparability.

The text is, and should continue to be, a standard of quality in the auditing education market. This new edition is, overall, an improvement in an already highly regarded textbook.

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DONALD E. KIESO and JERRY J. WEYGANDT, *Intermediate Accounting*, Fifth Edition (New York: John Wiley & Sons, 1986, pp. xxii, 1274, $40.95).

One of the best gets better. Like its predecessors, the fifth edition continues the high quality that users of this text have come to expect. This edition is one of the most up-to-date books on the market with its incorporation of the FASB's new pension standard. Many topics benefit from numerous changes: refinements, clarifications, new illustrations. Overall organization of the book has been improved by both intra- and interchapter reorganization. This coherent chapter coverage and the excellent assignment material will continue to place the book at or near the top of the adoptions list.

While each chapter has its share of refinements and new illustrations, the most noteworthy features of this edition are the chapter on the time value of money and the chapters on pensions, inflation accounting, and the statement of changes in financial position—each a major revision to conform to recent FASB actions:

- The material on the time value of money (Chapter 6) has much better examples and illustrations with the addition of numerous time-line diagrams in this edition.
- Pension accounting (Chapter 21) coverage is based (presumably) on the exposure draft of SFAS 87. With the final standard being essentially the same, the chapter discussion of the required procedures is adequate (and certainly more up-to-date than many intermediate texts). One shortcoming is the lack of a complete discussion involving the conceptual aspects of pension accounting.
- Accounting for inflation (Chapter 25) coverage is based on SFAS 82. The chapter has been rewritten extensively with succinct examples and better illustrations.
- Coverage of the Statement of Changes in Financial Position (Chapter 24) now reflects the emphasis on the cash basis reflected in SFAC 5. In addition, the chapter has many new illustrations and statement formats.

Other chapters benefit from many changes. Numerous (far too many to mention) new illustrations have been added throughout the fifth edition. Nonsubstantive changes include a new multi-color layout with illustration boxes, titles, and paragraph headings emphasized in color. End-of-chapter assignment material remains basically the same as in the fourth edition (reviewed October 1983, pp. 854–855).

A continuing major strength is the presentation (up front in Chapter 3) of material on conversion from cash to accrual. Such early emphasis has always set this text apart from its competitors. Instilling the notion of day-to-day accounting (journal entries) as being essentially cash-based lays the groundwork for dealing with many subsequent concepts on subjects such as: (1) timing differences in income tax accounting (Ch. 20); (2) error making and correcting (Ch. 8 and 23); and (3) the direct approach for preparing the Statement of Changes in Financial Position on a cash basis (Ch. 24). This emphasis also gives additional rationale for adjusting entries in the first place.

The book continues to be an excellent blend of conceptual and procedural presentations with few surprises. It is well written, well organized, and has appropriately rigorous coverage. This edition has many new examples and a wealth of additional illustrations. The authors have expanded, reorganized, and rewritten to improve the book. The key attributes of the fifth edition are its up-to-dateness and its numerous refinements.

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KERMIT D. LARSON and WILLIAM W. PYLE, *Financial Accounting*, Third Edition (Homewood: Richard D. Irwin, Inc., 1986, pp. xx, 720, $32.95).

Financial Accounting is designed for the first course in accounting and is directed at accounting, business, and nonbusiness students. Its intent is to provide a sound background in financial accounting, reporting, and analysis that will help the students in their personal affairs, in succeeding business and finance courses, and/or in courses leading to a career in accounting.

This text is based on *Fundamental Accounting Principles* by the same authors and closely follows the style and content of the financial portion of that text. The first edition of this text (reviewed October 1980, pp. 701–702) apparently was designed to provide a text for those schools that prefer separate courses and texts for financial and managerial accounting or that have only one term of accounting for their non-accounting majors. The text serves that purpose very well.

While the topical content of the third edition is essentially the same as previous editions (revised edition reviewed October 1983, pp. 860–861), the authors have completely rewritten several chapters and parts of others. The result is a text that recognizes many of the important trends in financial accounting—for example, greater attention is given to the role of computers in business and accounting, and emphasis is given to both the cash and working capital bases of statements of changes in financial position. In brief, the text is in tune with current trends and developments in accounting.

To help the student, each chapter provides some objectives at the beginning, and a glossary and review questions at the end. Illustrations are clear and many have color highlights of the new material. The text is written in a style that should be understandable and easy for students to follow. A number of student aids are available—a book of working papers, a study guide, and a list of check figures. A microcomputer study guide also is available for tutorial purposes.

The teaching package includes a solutions manual, transparencies of solutions to all exercises and problems, and a set of teaching transparencies. Also available is a computerized test bank by telephone from the publisher, a microcomputer test bank which includes exercise-type problems as well as multiple-choice and true-false questions, and a computerized grade book. Two microcomputer practice sets also are available.

This text contains a blend of "how to" and "why." The traditionalist will find ample use of journal entry illustrations and problems for homework. At the same time conceptual discussion is not neglected and "provocative" problems based on real-world situations are provided throughout. This book merits consideration by those searching for a one-term introductory textbook.

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MICHAEL MULRONEY, *Federal Tax Examinations Manual* (New York: John Wiley & Sons, 1985, pp. xxv, 584, $65.00).

In the preface, the author states that he attempted to discuss federal returns examinations from four points of view: those of the Internal Revenue Service, an attorney, an independent accountant, and an honest taxpayer. Such a diverse intended audience, coupled with the approach of law scholars to footnote everything, left the reviewer frustrated. The lack of a specific audience raised the question: "Who did the publisher think would purchase and use this manual?"

Although this manual has a wealth of information, it has too many Internal Revenue Code references and court citations for the person seeking a general knowledge of the subject. One chapter has 419 citations and footnotes! But for the practicing attorney or accountant, too much basic information is intermixed with the more esoteric points. For example, a discussion of adequate books and records of an individual appears on page 98, and the paragraph on page 89 advises that the return preparation process should begin early enough to permit the accumulation of data, preparation of the return, and a time to set the proposed return aside for a later review before the actual filing.

For the somewhat knowledgeable reader, an additional frustration is the need to have the Code and Cumulative Bulletin handy. In the chapter discussing tax shelter examination programs, a listing of the criteria that help determine if a shelter should be audited includes the following: "Whether a section 761(a) election is involved" (p. 307); and "A second aspect of the completeness question is how much detail should be furnished in supporting schedules. Some return information requirements, if strictly complied with, are virtually unworkable in the real world (see, e.g., Rev. Proc. 75-25, 1975-1 C.B. 720.)" (p. 93).

The first sentence in the preface says the subject matter is examination of federal tax returns by the Internal Revenue Service. Yet the first third of the book deals with such matters as the organization of the Service, the purpose of a return and who must file, books, records, accounting methods and periods, and professional conduct of attorneys and accountants in tax planning. The next third of the book concentrates on the examination process starting with the selection and assignment of returns for examination. This section discusses the examination procedure according to the type of audit, service center or district, office or field examinations, classified by type of return. Included in this section is a chapter dealing with special types of examinations such as tax shelters, international operations, employee plans, and exempt organizations.

The last three chapters discuss a number of procedural or strategic matters that could occur during the audit process. The topics include the pros and cons of asking technical advice from the National Office, the Service's powers of information gathering through the use of summons, the Freedom of Information Act, the closing procedures of various types of audits, civil litigation arising from the examination, and assessment and collection procedures. Included are eight tables cross-referencing such items as cases, forms, Internal Revenue Manual Sections, code, regulations, and revenue rulings to the text.

This manual quotes extensively from the Internal Revenue Service Manual and offers insights from the author's experience as a partner in a Washington, D.C. law firm. These insights, usually given in sections labeled "Comment," offer strategies and hints for dealing with the Service in examinations proceedings.

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GARY JOHN PREVITS, *The Scope of CPA Services: A Study of the Development of the Concept of Independence and the Profession's Role in Society* (New York: John Wiley & Sons, 1985, pp. xv, 187, $39.95).

The author has set himself an ambitious task in his new work, and has carried it off well. The book considers services by CPA's in public practice, as they relate to a profession's responsibility to address societal expectations. Competence and independence traditionally have been listed as important attributes of a profession. The book focuses on the expansion of CPA services and singles out independence as the essential reference point. The developments that impelled expansion of services are divided into a series of "episodes." The events so classified then are reviewed through the prism of the particular time.

The occasionally diverging views of the AICPA and the SEC are discussed concisely. ASR No. 22 (1941) set out the concept of the appearance of independence as differentiated from what was in fact a lack of independence. The importance of judging appearance was reiterated in ASR No. 47 (1944), which identified certain proscribed situations. In 1950, the SEC prohibited any direct financial interest by an auditor in his or her client; the AICPA's more moderate rule merely banned a substantial interest. (The difference was not reconciled until 1962.)

The AICPA revised its rules on consulting in 1973 and stated that while a CPA need not be concerned with the appearance of independence in performing such services, he or she should consider whether such services could be considered to lack independence in the eyes of a reasonable observer. Henceforth, the meaning of independence could differ with the nature of the service performed by the CPA. In any event, if independence is to remain a viable concept, its meaning can be expected to evolve further as the demands of society change.

"[N]o third party outside the consultant-employer relationship . . . relies on the work of the CPA-consultant in the same manner in which the investor relies upon the CPA fulfilling the attest role" (pp. 158–159). Consequently, as the author also states, recognition that the attest function has given the contemporary CPA profession its character implies an impact upon other evolving services.

Of particular interest is a section in the concluding chapter in which the author outlines "guideposts" for the future; he stresses the need to ensure informed compliance with the requirement of independence, recognition of the role of government, and further research by academics.

Although this reviewer finds little to quibble with, the author might have discussed some of the answers being developed outside the United States to resolve independence-related issues. Also, one would hope for a future companion volume in which the same erudite author addresses the subject of auditor competence.

This little book is recommended for students' supplemental reading at both graduate and undergraduate levels.

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WILLIAM W. PYLE and KERMIT D. LARSON, *Fundamental Accounting Principles*, Tenth Edition (Homewood: Richard D. Irwin, Inc., 1984, pp. xx, 1031, $35.95).

The tenth edition of *Fundamental Accounting Principles* continues the traditional approach to the first-year course in accounting developed in the previous nine editions. The authors have attempted to provide a comprehensive introduction and overview of accounting that is suitable for both accounting and nonaccounting majors. But by addressing multiple audiences, the authors face the difficult problem of providing a blend of breadth and depth that is appropriate to each group. Drawing on the experience developed in previous editions and relying on the entrenched orientation to the introductory course that they have helped develop in many accounting instructors over the years, the authors have a text that meets the needs of most traditionally-oriented programs and instructors.

The book is readable and the illustrations are generally clear and appropriate. Objectives are stated at the beginning of each chapter and a glossary and review questions are provided at the end of the chapter. A limited number of short exercises are available in each chapter for class discussion or homework assignments. Each chapter contains two sets of problems—with the second set essentially identical in scope and concept to provide alternate assignments in following terms. More thought-provoking problems also are provided for instructors who prefer less deterministic assignments for their students.

The authors continue to provide a broad range of supplementary materials to help the student and the instructor. Available are manual and computerized practice sets, working papers, study guides, achievement tests, additional examination materials, machine-gradable tests, a computerized test bank for microcomputers, instructor lecture guides, solution manuals, a complete set of transparencies for the assignment materials, and check figures. All of the materials are well prepared and appropriate, with one exception. The computerized test bank provides only true-false and multiple-choice questions, but short exercise/problem types would be most helpful for the instructor who prepares his or her own tests.

A review of the ninth edition (July 1981, pp. 743-744) generally was favorable as to the logic and style of writing. This edition contains some changes in organization and minor additions of topics, but the general tenor is similar to previous editions. Previous users will find much that is familiar and acceptable to them. New users will find the content to be comparable to other traditional introductory accounting texts, with the organization of the book and writing style quite understandable to them and their students.

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Letricia Gayle Rayburn, *Principles of Cost Accounting: Managerial Applications*, Third Edition (Homewood: Richard D. Irwin, Inc., 1986, pp. xx, 1016, $38.95).

Two obvious changes in the third edition are (1) the two-color printing and (2) the sequencing and grouping of some chapters. Two-color printing certainly has the advantage of highlighting headlines, exhibits, and illustrations to differentiate them from text material.

The text consists of 24 chapters organized into seven parts. The first two parts (nine chapters) emphasize product-costing topics. The third part (two chapters) covers standard costs and variance analysis. The fourth part (three chapters), described as Cost Analysis for Decision Making, consists of separate chapters on cost-volume-profit analysis, variable costing, and decision models and cost analysis under uncertainty. The fifth part (four chapters) deals with budgeting, behavioral factors, and capital budgeting. The sixth part (two chapters) covers the quantitative models for planning and control. The last part (four chapters) on performance evaluation and pricing analysis includes separate chapters on marketing analysis, pricing decisions, segment analysis, and transfer pricing. This organization still permits chapter coverage in a different order without substantial discontinuities.

The major change in chapter sequence is grouping the two budgeting chapters with behavioral factors and capital budgeting and placing them immediately after the material on cost analysis for decision making. This change separates budgeting material from standard costs and variance analysis, and moves the behavioral factors from performance evaluation to a more logical place with the budgeting material.

The third edition has changed end-of-chapter exercises, problems, and cases, which provided variety and extensive coverage in the revised edition. Some favorite assignment material has disappeared. In many cases, exercises and problems have the same format with different numbers. The range of coverage and variety of exercises and problems is less than in the previous edition. This is particularly true in the chapters covering several topics. Instructors who assign those chapters may need to use supplementary materials.

The text continues its consideration of Cost Accounting Standards, which are discussed in appropriate chapters and enumerated in an appendix. But the material is not integrated into the chapters. CAS 418, for example, gives guidelines for creating overhead cost pools. This information would fit well in the discussion of departmental overhead rates versus a plant-wide rate. Each of the standards can provide valuable material for several cost accounting subjects.

The third edition continues the use of detailed and complex illustrations that confuse and frustrate students. The most notable chapters are on process costing. Additionally, instructors will still find the text inadequate if they wish to emphasize quantitative techniques, learning-curve theory, regression analysis, decision making under uncertainty, and variance investigation.

Overall, the text provides a balanced conceptual and procedural emphasis, is written reasonably well, and covers the traditional cost-accounting topics. This reviewer agrees with the reviewer of the revised edition (January 1984, pp. 151-152) that the text is suitable primarily for undergraduate courses. The topic emphasis and presentation level make the text less appealing for graduate-level courses.

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GAIL LEVIN RICHMOND, *Federal Tax Research: Guide to Materials and Techniques*, Second Edition (Mineola, NY: The Foundation Press, Inc., 1985, pp. xvii, 126, $7.95 paper).

This booklet is a compact, very helpful, tax-oriented, expanded version of the author's contribution to *Fundamentals of Legal Research*, Third Edition, by Jacobstein and Mersky (The Foundation Press, Inc., 1985).

In 46 pages, the author summarizes the primary authorities (i.e., statutes and judicial and administrative interpretations). As these authorities appear in various sources and as many looseleaf services contain both primary and secondary authorities, the author effectively lists the various research tools available, cross-referenced to later chapters where the secondary authorities (i.e., looseleaf services and periodicals) are described in detail. The cross-reference system is made even easier as the section under analysis is indicated in the upper left margin of each page.

The booklet contains a chapter describing various computer-assisted tax/legal research methods, descriptions of the various Shepard services and some of their benefits, and detailed comparisons among the C.C.H., P.H., and R.I.A. tax services and Merten's *Law of Federal Income Taxation*. It also includes various illustrations and basic hints for optimizing research time. But this reviewer noted the absence of comments on full utilization of Shepard's, headnotes, and the West Key System to expedite research time on narrow tax/legal issues.

This booklet should be very useful not only to graduate students in a tax research course but to anyone desiring an understanding of the various tax research tools.

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JERRY M. ROSENBERG, *Dictionary of Banking and Financial Services*, Second Edition (New York: John Wiley & Sons, 1985, pp. xv, 708, $34.95 cloth, $16.95 paper).

This impressive volume is a dictionary of some 15,000 banking, finance, insurance, and accounting terms. It is a major reference work that would be a useful addition to libraries of accounting (and/or) finance schools or departments as well those of colleges and universities.

H.S.H.

PAUL ROSENFIELD and STEVEN RUBIN, *Consolidation, Translation, and the Equity Method: Concepts and Procedures* (New York: John Wiley & Sons, 1985, pp. xi, 252, $39.95).

This compact entry in the Wiley Series in Professional Accounting and Business is meant to be, and is, a manual for practitioners, more instructive in its topics than a handbook and more concise than most textbooks. Its authors, the director of and a manager in the AICPA Accounting Standards Division, have produced a clear and efficient "how to do it" for the professional who may be rusty in its areas. Relying on a series of good illustrations, the book moves rapidly from "square one" consolidation procedures and translation concepts to a final "Special Topics" chapter, a series of illustrations of, for example, changes in percent of stock held.

The book is not intended as an issues discussion; accounting theory is not addressed beyond identification of concepts underlying present standards. Rather it demonstrates application of existing ARB, APB, and FASB pronouncements via the text and a well-chosen set of example annual report financial statements and disclosures. A second appendix, "Contemporary Issues in Consolidation, Translation, and the Equity Method," does identify ten "challenges to present concepts and procedures" (e.g., merits of consolidated reporting, treatment of minority stockholding, purchase versus pooling, GAAP for foreign operations). However, in 11 pages the ten "issues" are merely raised.

The initial two chapters introduce basic concepts. SFAS No. 52, including both foreign currency transactions and financial statement translation, is demonstrated in an efficient, 24-page third chapter. Consolidation technique at and after the combination date is followed by an Equity Method chapter, the final 80-page "special topics" chapter, and the two appendices. The book has no "end-of-chapter" materials. The writing style is terse and clear, better suited for the experienced than the student accountant. Editorial layout often inserts pieces of text over several pages of illustrations, to the discomfort of the reader (and no doubt the authors).

References to relevant SEC positions are lacking in this practitioner-oriented book. SEC regulations and/or rulings on the meaning of "control," consolidation of R&D subsidiaries, and disclosures regarding unconsolidated subsidiaries/investees and intercompany resource flow restrictions or guarantees, as examples, would seem of interest to such readers. "Push down" accounting is mentioned but briefly, then only as an AICPA proposal to the FASB.

This book serves its purpose well—an applications manual/text for financial accountants. But for the academic accountant it serves neither as text, textbook supplement, nor research source. Teachers and students may find the alternative presentations useful, but all its topics typically are covered in popular advanced accounting texts. The annual report financial statement and disclosure examples of consolidation and of foreign currency translation treatments do provide good classroom illustrations. The authors are scrupulously neutral in matters of theory, allowing themselves only in the "Issues" appendix to briefly criticize certain elements of current accounting standards but offering no alternatives. Clearly they have reviewed the literature, as evidenced by extensive citations on the balance sheet nature of minority interest. But consistent with the interests of a practitioner audience, citations generally are limited to promulgated standards.

Thus among academicians it is primarily the "advanced accounting" teacher who may find the practitioner-oriented alternative presentation style to be interesting and the annual report examples to be useful.

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Jack L. Smith, Robert M. Keith, and William L. Stephens, *Accounting Principles*, Second Edition (New York: McGraw Hill Book Company, 1986, pp. xix, 1108, $34.95).

This revision of a widely used text in elementary accounting continues to build on many strengths of the previous edition (reviewed July 1984, pp. 537–538). Of its 27 chapters, 19 (including Income Taxes) have a financial orientation and eight concern themselves with cost or managerial topics. The entire text can be covered in either two semesters or three quarters.

The book retains the authors' writing style, which contributes to its pedagogical effectiveness. They speak to the student in the third person simply and directly. Rhetorical questions are asked, then answered in detail, a very strong point of the book. The preface states "the text is intended for use . . . by those students who plan to enter the accounting profession, those who plan a business career, and those who have an interest in broadening their business background" (p. xv). Despite these very broad and appropriate student-reader-oriented goals, sometimes inordinate attention is given to the "busy work" or mechanical aspects of learning the subject, especially for nonmajors.

As in the previous edition, each chapter begins with a series of specific learning objectives that complement textual materials. Chapter summaries and glossaries succinctly wrap up concepts and new terms introduced.

The text again makes extensive use of pictorial materials such as flow charts, diagrams, and other exhibits to help students understand concepts and relationships.

Near the middle of the book (between Chapter 11 on current liabilities and Chapter 12 on partnerships) is a very good discussion of GAAP. It is quite similar to the one found in the first edition. Questions track the material well to test students' comprehension of concepts and issues raised.

Prior to introducing management accounting topics, the authors present the 1983 and 1984 annual reports of the Florida Steel Corporation without questions and without comments on how the text applies to their preparation or to understanding them. On average, each chapter has 18 questions and 23 exercises and problems, up from the first edition's 17 questions and 22 exercises and problems. The problems are divided into A and B groups. Complexity increases from first to last. Some problems are very challenging; many ask students to write out journal entries and to prepare statements or schedules emphasizing accounting mechanics. Exercise and problem format continues the first edition's practice of providing a marginal note and check figure.

As a general observation, major topics and issues of accounting are more than adequately covered. Some chapters and topic coverages are especially well done.

The book has a few weak points. They are relatively minor in nature. First, the authors use negative numbers when illustrating the preparation of income statements rather than the more typical "less" notation. Second, balance sheet presentations combine beginning owner's equity, income, and withdrawals to calculate ending equity rather than showing this on a separate statement. Third, the expense account, transportation-out or freight-out, is not discussed within the context of merchandise inventory accounting. Fourth, the double taxation discussion of Chapter 13 does not clearly explain taxation alternatives specifically available to owners of closely held corporations. Fifth, Chapter 13 on the formation of corporations does not mention the stockholder ledger, the subsidiary ledger to the capital stock account. Sixth, in the chapter on long-term liabilities (Chapter 15), a long-term mortgage payable example is not included. One also may question including 15 pages of payroll accounting given some of the book's stated orientations.

Since many business students may be employed currently or in the future by not-for-profit entities, a more expanded discussion of accounting unique to such organizations might have been appropriate and responsive to the authors' goals stated in the preface. Except for two very short paragraphs on page 7, not-for-profit entities are not discussed.

Pragmatically, the selection of a text involves a careful evaluation of a series of trade-offs. These trade-offs concern themselves primarily with individual preferences as to which financial and managerial accounting topics should be omitted, and the depth of discussion of what is included in the text. This book is a valuable addition and is worthy of consideration for adoption in elementary accounting courses, primarily at the undergraduate level.

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JAY M. SMITH, JR. and K. FRED SKOUSEN, *Intermediate Accounting: Comprehensive Volume*, Eighth Edition (Cincinnati: South-Western Publishing Co., 1984, pp. xii, 1064, $27.95).

The authors' objective for the eighth edition of this text was to make it "the most teachable intermediate text on the market" (p. iii). Having received positive feedback on the seventh edition, it is not suprising that they have made only minor changes in the text and assignment material. The same 25 chapters are included in the same order as in the previous edition. In addition to incorporating recent authoritative pronouncements and the effects of changes in the federal tax laws, some changes appear to be in response to criticisms and recommendations made in the review of the seventh edition (January 1982, pp. 237–238). These include revising the introduction to the income statement in Chapter 4 to add "below the line items," and including an appendix to Chapter 23 demonstrating the T-account approach to preparing the funds statement. Improvements to make the text more teachable include changing the illustration in Chapter 2 from a manufacturing company to a merchandising company and adding the T-account approach to funds statement preparation. One other addition is the appendix to Chapter 24 illustrating the use of current values on personal financial statements.

The text is not without shortcomings. Accounting for serial bonds is illustrated with the straight-line method of amortization of premium and discount. Since GAAP requires the effective interest method, the primary discussion should illustrate this method. The coverage of earnings per share would be improved if the authors illustrated the shortcut method using rank order for determining whether convertible securities are dilutive or antidilutive. The now outdated chapter on pension accounting needs a supplement for the student covering SFAS 87 and 88, but apparently none will be forthcoming because the new edition is scheduled for early 1987.

In summary, as in the previous edition, the text provides a balanced conceptual and comprehensive procedural presentation of the conventional intermediate accounting topics. It is well written, contains an abundance of assignment material, and offers a complete set of supplementary materials. Serious consideration should be given to this text by those seeking a good, teachable intermediate accounting text.

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LANNY M. SOLOMON, RICHARD J. VARGO, and LARRY M. WALTHER, *Accounting Principles*, Second Edition (New York: Harper & Row, Publishers, Inc., 1986, pp. xvi, 1135, $35.00).

The second edition of this text continues the tradition of the first (reviewed January 1984, pp. 154–155) with well-written textual material, accompanied by understandable examples and illustrations. Employing standard terminology and conventional coverage of accounting principles topics, the authors have avoided the pitfalls of attempting to reinvent the wheel. The illustrative financial reports and excerpts from periodicals add to students' interest.

Several organizational changes have been made in the second edition. The introductory chapters on the accounting cycle have been reorganized and expanded, integrating the fundamental financial statements with the coverage of related topical materials. Inclusion of the more complicated and confusing topics, such as earnings per share, has been deferred to later chapters. While adjusting and closing entries are adequately covered with good illustrations, the authors could have included the adjusting entries for a deferral had the original entries been recorded in nominal instead of in real accounts. A brief appendix has been added on reversing entries, but it has no illustration of reversing entries for deferrals, and no discussion of rules for using optional reversing entries.

Other organizational changes include the separation of partnerships and the introduction to corporations into two different chapters. The effect of inflation is introduced at an earlier point with the presentation of accounting concepts. The international perspective of accounting has been added in the chapter on financial statement analysis. The chapter covering the calculation of taxable income and the tax liability has been moved to the final chapter, as seems to be the trend in many texts, providing for optional coverage of this material.

Authors of principles texts always face the problem of deciding the depth and breadth of coverage. These authors have been successful in dealing with this problem; by covering the basic concepts with references to alternative methods of accounting for various items, they avoid the confusing practice of including every method for every topic. For instance, the FIFO flow assumption is quite adequate for an introduction to process costing in a principles text. The authors' presentation of the consolidation material at this level is concise and yet understandable. The inclusion of the work-sheet approach for preparation of the statement of changes in financial position in an appendix allows for optional coverage, should the user prefer this method.

The exercises and problems are well constructed with the exercises concentrating on single topics quite adequately for initial assignments on fundamental concepts. Users will find that the problems are related to materials covered in the chapters, but the authors have not fallen into the trap of the cookbook approach. Good, thought-provoking problems are included that require integration of previously covered concepts. The authors have deleted weaker problems from the first edition, and provided additional problems. A second set of problems is included, but many are very similar to the primary set. New cases also have been included.

The ancillary materials are helpful and well prepared. The solution manual appears to be essentially error-free. The test banks are excellent sources of objective questions. The instructor's resource manual reiterates the learning objectives, briefly outlines the topics covered, and recommends transparencies and assignments for each chapter. From the students' perspective, the working papers are well organized and labeled, and the study guide is a valuable review device. Four manual and one computerized practice sets also are available.

This edition is well written, organized, and presented. The supporting materials are well prepared. Users will find this text an excellent choice for a two-semester accounting principles sequence at the undergraduate level.

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G. FRED STREULING, JAMES H. BOYD, and KENNETH H. HELLER, *Federal Taxation of Partners and Partnerships* (Englewood Cliffs: Prentice-Hall, Inc., 1986, pp. xii, 466, $36.95).

Filling a gap among tax textbooks, this book provides a sound alternative for an instructor seeking a book to use in a graduate-level partnership course. The book is both conceptual and practical (e.g., Table 1-2 illustrates the aggregate and entity concepts through an analysis of Subchapter K Internal Revenue Code sections). It is tightly and well written.

A wide variety of questions and problems is a welcome feature that distinguishes this book from the competition. The problems range from straight-forward applications of the law to rigorous analyses that involve a solid understanding of a wide variety of topics.

A life-cycle approach is used effectively by the authors to structure their coverage. At times some historical perspective is offered, and quotes from the Internal Revenue Code are well placed and serve a definite purpose when used. Every chapter has several excellent examples, most of which are easy to follow and illustrate the particular provision effectively. However, in Chapter 8, Unrealized Receivables and Inventory, three examples (numbers 8, 11, and 13) are so detailed that they had to be covered in class. Even with this treatment, they were difficult to follow due to the volume of information.

One feature of the book that makes a substantial contribution to the learning experience is the presentation of tables which summarize a great deal of material. For example, Table 2-1 views the tax consequences to both the transferor partner and the transferee partner when money, other property, and/or services are contributed to a partnership.

Tax planning is not emphasized by the authors. In most instances, the topic is discussed but not illustrated. More examples similar to the planning strategy given at the end of Chapter 8 would strengthen the book.

Shortcomings in this offering are not easy to uncover. However, a semester of living with the book did reveal some. The early chapters should be supplemented with an article that compares the tax and nontax aspects of partnerships, S Corporations, and regular corporations. Although students probably have been exposed to the material elsewhere, a review and update is beneficial. No research problems are included in the book; this is a serious omission. Extensive coverage of Section 751 activity is deferred until Chapter 8. In my opinion, shifting some of this material to an earlier location (e.g., Chapter 5) would make a good book even better.

Overall, the book is an excellent one to use as the primary text in a partnership course taught to graduate students. Streuling, Boyd, and Heller cover the concepts of partnership taxation and provide a practical approach to the provisions that affect partnerships. Coverage of tax shelters is facilitated since one chapter deals specifically with limited partnerships.

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UNITED NATIONS CENTRE ON TRANSNATIONAL CORPORATIONS, *International Accounting and Reporting Issues: 1984 Review* (New York: United Nations, 1985, pp. xi, 122, $13.50 paper).

As multinational corporations (MNCs) account for a substantial portion of the world's gross product, they have been scrutinized closely by national, regional, and international organizations. In 1972, out of the increased concern over corporate accountability and social responsibility to the international community, the Economic and Social Council (ECOSOC) of the United Nations (UN) commissioned a Group of Eminent Persons to study the impact of the activities of MNCs on economic development and international relations. During the course of its investigation, the Group found a serious lack of usable financial and nonfinancial information on the activities of these MNCs and limited comparability among the data disclosed in corporate annual reports. Inevitably, the UN began to direct its attention to the heart of the matter—accounting standards and disclosure requirements.

This UN publication is a summary of various accounting-related issues considered by the Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting at its second session held in March 1984. To understand the significance of the report, readers need to know a brief history of UN involvement in international accounting issues.

In response to a report prepared in 1974 by the Group of Eminent Persons, the Center on Transnational Corporations was created to develop a comprehensive information system on the activities of MNCs. Its primary objectives are threefold: "(a) To further understanding of the nature and the political, legal, economic and social effects of the activities of transnational corporations [the term 'transnational' in the UN usage applies to any corporation operating internationally] in home countries and host countries, and in international relations, particularly between developed and developing countries; (b) To secure effective international arrangements for the operation of transnational corporations designed to promote their contribution to national development goals and world economic growth while controlling and eliminating their negative effects; (c) To strengthen the negotiating capacity of host countries, in particular the developing countries, in their dealings with transnational corporations" (p. 85).

Although the Centre has been making an arduous effort to accomplish its objectives, its progress has been slow. In 1976 a Group of Experts on International Standards of Accounting and Reporting was appointed. Its report, however, was not adopted in 1978, because members of the Group were not government representatives of their respective countries. In 1979 an Ad Hoc Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting was formed. This group met in early 1980, but its final report was delayed until late 1982. The UN, however, reaffirmed the importance of its involvement in pursuing international harmonization of accounting and reporting standards. Thus, according to an ECOSOC resolution in 1982, the Intergovernmental Working Group became a permanent body. It is composed of 34 members who were elected on the principle of equitable geographical distribution and include the following seven intergovernmental and non-governmental organizations: the World Bank, the European Economic Community, the Organization for Economic Cooperation and Development, the International Chamber of Commerce, the International Confederation of Free Trade Unions, the International Accounting Standards Committee, and the International Federation of Accountants.

This UN publication is written in a style similar to typical corporate minutes. But it makes interesting reading since it contains results of three separate, but interrelated studies: a questionnaire survey collected from 42 countries on their standard-setting and implementation processes (Chapter 2); a 20-country survey of accounting and reporting practices in 16 key areas (Chapter 3); and issues identified in the course of developing the comprehensive information system (Chapter 4). In addition, the final chapter (Chapter 5) deals with three critical issues in international reporting: movements of certain assets, transfer pricing, and value added.

As evidenced from the report, the UN seems to have identified the diverse accounting and reporting standards and practices currently being followed in different countries. Two key issues still remain to be solved: how to increase the availability of corporate financial and nonfinancial data and how to enhance the comparability of the data. This report should certainly raise many questions in the minds of thoughtful readers. It is "must" reading for researchers, practitioners, and corporate executives who are involved in international accounting and reporting issues.

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JOSEPH W. WILKINSON, *Accounting and Information Systems*, Second Edition (New York: John Wiley and Sons, 1986, pp. xxii, 986, $37.00).

This revision of the 1982 text retains the objectives, scope, and style presented in the first edition (reviewed October 1982, pp. 859-860). The addition of three chapters (use of modular structure, elaboration and expansion of data management, and data control and security measures) are the main new features of the second edition. This volume carries an additional 141 pages.

The framework of this text consists of five parts. Part I is structured in six chapters to provide the reader with accounting-related concepts of information systems, organization structure, and managerial decision making. Significance of reporting, controls and documentation, and general review of accounting procedures used in transaction processing are also examined. Part II is a seven-chapter building block devoted to a variety of elements used in a computer-based information system. Impacts of computerization, evolution, types of computerized data processing, data structure, and data management are discussed. Control aspects, security measures, and audit techniques also are examined. Part III examines the nature, evolution, and relevance of communication networks, microcomputers, and decision support systems. Part IV consists of four chapters designed to provide the traditional phases of systems development: planning, design, selection, and implementation. Part V presents two comprehensive cases as an option for project assignment.

The strengths of this text are:

- Fulfillment and achievement of the author's stated objectives. This is supported with the logical sequencing and presentation of concepts, computer-based information systems, emerging developments, and systems development.
- Flexibility of class adoption and assignment of topics. The book provides a flowchart as an aid in selecting material coverage and preparation of course outlines.
- Sufficient knowledge is provided to help bridge the gap between business functional areas and computerized information systems.
- Substantial emphasis on control aspects, auditing procedures, and security measures provides effective tools needed in advanced courses in auditing.
- The review problems at the end of each chapter and the two comprehensive cases are effective tools in the learning process.

The main shortfalls of this text can be summarized as follows:

- The unnecessary redundancy of information and discontinuity of presentation overload the reader with a list of definitions and references to material covered in later chapters.
- Lists and tables are used abundantly without

adequately preparing readers to proceed, causing difficulty in comprehending the material covered.

- Coordination is lacking between end-of-chapter problems and chapter content. Prior knowledge in operations research, production management, marketing, and management also is assumed in solving some assignments.
- The flowchart appendix needs to be presented and discussed in a more detailed and systematic structure.

In conclusion, this text is a positive contribution to knowledge in the area of information systems. It is challenging and puts the teacher on guard to be adequately prepared for effective class participation and interaction. A number of improvements could make the third edition an even better text.

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SOFTWARE SUMMARIES

Harvey S. Hendrickson, Editor

FCS: A Decision Support System (DSS) (Chelmsford, MA: THORN EMI Computer Software, Mainframe Version Site License negotiable, Maintenance $900 to $2250 per annum depending on configuration; *Micro FCS: User Reference Guide*, 1986, pp. v, 475, looseleaf, $100 per copy, maintenance $50 per annum, prices are for universities only).

FCS is an *integrated* decision support system (DSS) with both a mainframe version and a microcomputer version (MICRO-FCS). It is one of several similar DSSs being used extensively by large and small firms for a variety of problems such as financial planning, budgeting, investment analysis, etc. The mainframe version is available on IBM and IBM plug-compatible computers, on the DEC VAX, Wang VS, and HP 3000 computers. MICRO-FCS, a subset of FCS, is available for IBM PCs and many IBM PC compatibles, the Wang Professional, and the HP 150. THORN EMI has a casual university support program, under which site licenses for the mainframe version and/or copies of MICRO-FCS can be obtained for a very reasonable percentage of the commercial rate.

FCS has two basic modules, a non-procedural logic (or model) module and a data module. A simple CALCULATE command merges a given data file with a given logic file. A working copy of the results then can be listed (e.g., projected cash flows over the next ten years). In a financial planning project, sensitivity analysis (what happens if values of key variables are changed) in a variety of forms is possible, as well as target analysis (what value one variable must have to achieve a desired target value for another dependent variable), and impact analysis (ranking of input variables by their impact on the value of some dependent variable). A report-generating module allows one to easily develop high-quality, finished reports in a variety of formats.

FCS incorporates a number of standard built-in financial analysis options. Of particular interest is its *risk analysis* capability.

An attractive feature of FCS is its hierarchical, consolidation capabilities (unfortunately not available in MICRO-FCS). Given a three-dimensional space composed of, say, financial statement entries, time, and organizational divisions, FCS can consolidate such statements up through as many organizational levels as desired, allocate overhead cost items to sub-units, make appropriate currency conversions, and then print slices of this three-dimensional entity along any axis at any level (e.g., comparison of indirect labor costs for the past five years for all North American divisions, comparative statements of retained earnings for 198x for all European affiliates).

FCS has a graphics capability with which one can do multiple, stepwise, and two-stage regression analysis as well as simple statistical analyses. Also available is a time-series analysis/forecasting module. Of major importance is that *all* of these modules can be linked and can interact with the basic data and logic modules. Data transfers among micro-computer spreadsheet programs, MICRO-FCS, and the mainframe are made easily. Also included is an integrated, interactive database management system.

Students can learn and use FCS quickly with the help of self-paced primers. Alternatively, black box applications can be developed for class use if time available is minimal. Separately or combined with a serious university support program, FCS would be a definite plus in an accounting department's software library.

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JACK A. HOLT, *Cases and Applications in Lotus 1-2-3* (Homewood: Richard D. Irwin, Inc., 1986, pp. xiv, 183, $16.95 paper, diskette free to adopters).

This comprehensive Lotus 1-2-3 supplement is designed to be used in a business quantitative methods course or in an introductory computer science course for business majors. The first half of the book is devoted to a detailed introduction to the operation of the Lotus 1-2-3 spreadsheet. Three appendices provide (a) detailed command trees, (b) a series of tutorials, and (c) 31 exercises and cases.

The detailed introduction to the operation of Lotus 1-2-3 will be appealing to both instructors and students. Individual commands are discussed and illustrated in considerable detail. The use of data tables, graphics, and database management are thoroughly illustrated. The introductory section concludes with a good discussion of Lotus macros.

The first of the three appendices consists of detailed command trees for all Lotus commands. These will be particularly useful for new users learning where to "find" various commands.

For each of the five tutorials in Appendix B, the student is given *every* keystroke required to complete a problem. The tutorials cover general spreadsheet development, data tables, graphing, and data management. The tutorials are well chosen; from this reviewer's experience, graphing, data tables, and data management are the areas most likely to cause difficulty.

The problems and cases in Appendix C cover a variety of topics (e.g., cash budgeting, present value analysis, product pricing, and economic order quantities). The range of difficulty is substantial. Integration of spreadsheet instruction and comprehensive cases and problems is a great strength of the book.

However, this strength also is a potential drawback. As noted earlier, the book is intended for an introductory computer science or quantitative methods course. If such a course is required early in a student's academic career, adopters may find that students have difficulty because they lack a foundation in accounting. For this reason, the book may be better suited to a course in management accounting.

A diskette with templates and completed solutions for the problems and cases is available from the author; it would be more convenient for adopters if the diskette were shipped by the publisher along with the desk copy. The author suggests making the templates available to the students. While this approach saves students' time, the disadvantage is that students do not get any practice at setting up spreadsheet models.

Potential adopters of the book should be aware that Lotus Release 2 commands and functions (e.g., regression analysis, matrix operations, and depreciation functions) are not included in this first edition.

In summary, this is an excellent book. The large format pages are easy to read; bold, clear headings facilitate locating specific topics within the text. The instructions and examples for the various commands are easy to follow. The book is particularly recommended to teachers of managerial accounting who wish to have a solid package of Lotus applications in their courses.

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DAVID M. KROENKE and DONALD E. NILSON, *Database Processing for Microcomputers* (Chicago: Science Research Associates, Inc., 1986, pp. xi, 347, $29.95).

The objective of *Database Processing for Microcomputers* is to apply mainframe database design and implementation experience to current microcomputer users. Pedagogically, the authors believe that learning is best achieved by doing; consequently, the text material includes a predefined database application which the students modify as each concept is presented. The text captures the contemporary view of information systems as responses to people's need to keep track of something—recording it, storing it, and retrieving it—to aid decision makers. The text capitalizes upon modern microcomputer technology, but more significantly, upon a sophisticated relational database, *RB5000*, called R:Base. R:Base serves as the vehicle to demonstrate the fundamentals of an information system's design, and as a mechanism to operationalize the concepts in a realistic functioning environment. R:Base is a commercial grade package, well ahead of the standard educational applications that accompany many current texts. The student R:Base version is "crippled," meaning that it will not store enough data to be commercially viable, but it does include the majority of the commands and modules found on the commercial version. That is a small compromise when compared to the learning capacity provided by R:Base.

The text is primarily applicable to the basic accounting systems course where the instructor wishes to provide a thorough experience in databases. Use of this text requires a threshold computer knowledge; thus it may not fit well into the introductory environment. Students must have access to microcomputers with at least two floppy disk drives (i.e., 5¼ inch, DSDD), MS-

DOS (tm) operating system, and 237K of user-addressable memory. Machines equipped with hard disk drives will perform as well.

The authors begin with an understandable explanation of database processing, stressing its advantages and disadvantages for information management. Conceptual points are developed with frequent illustrations, both schematically and for the R:Base software. Each chapter includes a summary and a set of content review questions. Database terminology is addressed specifically, listing the additional names that have been applied to similar concepts and structures by other databases. As with any developing field, the terminology is not consistent and can provide considerable frustration to the novice. The authors and R:Base use very logical names for each concept throughout their database and for the command set. The text does not include a comprehensive glossary. An accompanying instructor guide includes transparency masters, problem solutions, and teaching notes.

The text does not specifically address accounting internal control, but it does provide an extensive discussion on data security (Chapter 13) and use of the "Rules" facility in R:Base. The "Rules" and minor programming conventions can be used to demonstrate numerous controls within the database (e.g., validity checks, reasonableness checks, and logic checks). Database development moves from a programming perspective to creating an application that is menu-driven and "user-friendly," a concept frequently addressed by accounting system designers.

Overall, this text can serve as an excellent supplement to an accounting systems curriculum, where the instructor wishes to use an operating environment to teach systems concepts and implement their applications.

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MIKLOS A. VASARHELYI and W. THOMAS LIN, *TREAT* (New York: The Touche Ross Foundation, 1983, pp. 258, free upon request to nonprofit academic institutions).

The TREAT (Terminal Related Educational Audit Tool) system is an on-line interactive generalized audit software (GAS) package designed for computer audit instructional purposes. It also may be used for audit training in CPA firms. The system is based on the Touche Ross audit software package, STRATA; it emulates STRATA's main features, is simplistic in nature, and is a user of small simplified client files (databases). The source code is fully compatible with STRATA, allowing programs to be tested in an on-line mode and also executed later under a batch version of STRATA.

The TREAT package consists of four different micromodules (Definition Mode, Modification Mode, Execution Mode, and List Mode) with four audit cases that enable students to gain hands-on audit experience. The system also encompasses certain audit-related data processing functions, such as auditor file definition, mathematical functions, sampling functions, sorting function, summarization function, and report generation function. The features of the TREAT package are similar to the GAS packages of many accounting firms.

TREAT encompasses four audit cases. The inventory case requires the calculation of extended cost and the preparation of reports for taking physical inventory as well as an exception report for unit cost. The property, plant, and equipment case is slightly more computational—it uses depreciation and data exception. The accounts receivable case is even more complex; it requires aging of receivables, summarization of transactions, and application of payments. Finally, an extension of the accounts receivables case illustrates the updating of the Master file by Transaction files. Four other documents, An Introduction, User's Manual, Systems Manual, and Instructor's Manual, also are available with TREAT system.

The system is APL-based. This allows relatively easy adaptation to different computer installations (for example, IBM, UNIVAC, HP, DEC, BURROUGHS, and CDC equipment). The only requirement for TREAT installation is the availability of a time-shared mainframe with an APL interpreter. APL character-set terminals are not necessary for TREAT, but having access to one may be desirable for system installation and faculty use. A microcomputer version of TREAT can be requested. It is IBM PC-based, and requires the PC's APL implementation. The major limitations on TREAT use include: (1) instructors need to invest considerable time in learning the software and (2) the university's mainframe or personal computer needs an APL interpreter.

TREAT is less costly and less cumbersome for students to use than most accounting firms' GAS. It is suitable for instructors who are interested in integrating GAS into the audit curriculum to (1) teach and illustrate the usage of the computer in audit and/or (2) allow the student some partial experience that is similar to the audit process.

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NOTE: Readers interested in learning more about the TREAT system should contact:

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New York, NY 10027

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A PARTING NOTE

In this my final issue as Book Review Editor, I would like to thank those who contributed so willingly and generously to whatever success can be attributed to these pages of THE ACCOUNTING REVIEW during the past three years; these include:

- The many preparers of reviews, capsule commentaries, and software summaries who performed so expertly and then tolerated so humbly my many editorial changes that were sometimes brutal and often picky. Also included are several persons who were asked to prepare reviews of major works too late to be completed for this issue.
- Those who volunteered to do reviews, but have not been contacted; their names and/or letters will be passed along to my successor as well as to Valdean C. Lembke who is Book Review Editor (for textbooks) of *Issues in Accounting Education*.
- Those who suggested books for review and helped to find reviewers in difficult areas.
- The many accounting school and department heads and secretaries who provided information on textbook orders and users.
- Janet Nuñez, Copy and Production Editor, whose outstanding attitude,

competence, and efficiency make her not only indispensable, but one of the most professional and unforgettable persons who I have ever had the opportunity of working with.

- Gary Sundem, Editor, whose thoughtful assistance and collegial approach gave me the freedom I needed to function.

I also experienced disappointments in two areas. One was the case of persons who agreed to prepare reviews, and for one reason or another were unable to complete them. Unfortunately, some worthy books could not be reviewed. Another disappointment was that a qualified person for a given book sometimes was unable to serve as a reviewer because of being too busy with other activities.

Considerable effort has been expended to make certain that textbook reviews were prepared by users. This probably has made them more critical and evaluative. Hopefully, progress will continue in this area.

A summary of Book Review Section activities for the three years, April 1984 through January 1987, follows:

	Number of:			
	Books (and Related Items) Received	*Books Reviewed*	*Capsule Commentaries*	*Software Summaries*
April 1984–Jan. 1985	343	54	45	0
April 1985–Jan. 1986	441	86	84	5*
April 1986–Jan. 1987	363	58	65	13
Total—3 years	1,147	198	194	18
Average per year	382	66	65	12*
Average per issue	96	17	16	3*

	As a Percent of "Books" Received	
Books reviewed	(198÷1,147)	17.26%
Capsule commentaries	(194÷1,147)	16.91
Software summaries	(18÷591)*	3.05
		37.22%

* Software summaries were introduced in the October 1985 issue.

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H. I certify that the statements made by m
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Paul L. Gerhardt, Executive Director

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All enquiries about membership (including Corporate Membership and Library Subscriptions) should be addressed to Professor Susan Dev, Department of Accounting and Finance, The London School of Economics and Political Science, Houghton Street, Alwych London, WC2A 2AE, England. All enquiries about the journal should be addressed to Rob Gray, Department of Economics, U.C.N.W., Bangor, Gwynedd, LL57 2DG, UK.

ABACUS

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JANUARY 1987 PLACEMENT ADS

The deadline for information to be included in the "Placement Information" section is two months prior to the date of publication. The REVIEW *is published on the first day of January, April, July, and October. Placement advertising and replies should be sent to the American Accounting Association, 5717 Bessie Drive, Sarasota, FL 33583. All replies to box numbers should be on separate sheets to facilitate forwarding. There is no charge for this service to AAA members and associate members seeking employment. Others will be charged a fee of $100 per insertion. Ads should not exceed 100 words.*

#101 KANSAS STATE UNIVERSITY seeks applicants for one anticipated position at the rank of Assistant Professor. Ph.D. preferred. Doctoral candidates within one year of completion will be considered. Final review of applicants will begin February 15, 1987. Kansas State University, Department of Accounting, Calvin Hall, Manhattan, Kansas 66506. Affirmative Action, Equal Opportunity Employer.

#102 PORTLAND STATE UNIVERSITY, located in Portland, Oregon, invites applications for an expected permanent appointment in accounting. The available position is at the Assistant or Associate level. Research and teaching in taxation or accounting required. Applicants should possess a doctoral degree in accounting, although candidates at an advanced dissertation stage or applicants possessing an appropriate degree and a unique professional background that demonstrates expertise in taxation or accounting will be considered. Performance evaluation at PSU is based upon effective classroom teaching, research and publication, and university and community service. Programs are offered at both the undergraduate and graduate levels. The department enjoys a very close relationship with the professional accounting community in the state. Vita should be directed to Dr. Richard H. Visse, Head, Department of Accounting, Portland State University, Portland, Oregon 97207. Application deadline is February 18, 1987, or until the position is filled. PSU is an equal opportunity, affirmative action employer. Qualified minorities, women, and members of other protected groups are encouraged to apply. Salary range: $35,000–55,000.

#103 DBA IN ACCOUNTING, CPA. Have several years of university teaching, public accounting and business consulting experience. Served on national committees and have several publications. Interested in a university teaching position with institution which supports quality teaching, research and professional activity.

#104 CALIFORNIA STATE UNIVERSITY, SACRAMENTO has accounting faculty openings, effective August 1987, in its accredited AACSB undergraduate and master programs. Salary and rank open, commensurate with academic preparation and professional experience. For tenure-track positions, applicants must hold appropriate doctoral degree; professional experience and/or certification are recommended. Primary emphasis is on teaching effectiveness; research/scholarly productivity is required. Applicants in final stages of doctoral study may be considered for nontenure-track positions that may be converted to tenure-track if the doctorate degree is completed during the term of appointment. Visiting appointments with doctoral degrees or with major preparation and professional accomplishments (one-year temporary employment) may be available as needed. Send application letter and resumé to Chair, Department of Accountancy, School of Business and Public Administration, California State University, 6000 J Street, Sacramento, CA 95819-2694. Closing date for applications is March 1, 1987. CSU, Sacramento is an Equal Opportunity/Affirmative Action/Handicapped/Title IX/Vietnam Era Veteran Employer.

#105 CASE WESTERN RESERVE UNIVERSITY is seeking applicants for tenure-track faculty positions in accountancy. Qualifications required include a demonstrated capacity to undertake high-quality research and teaching in undergraduate and graduate professional accountancy courses. Skills in several specialization areas such as Auditing, Taxation, Not for Profit, and Financial Accounting are preferred. A doctorate or the equivalent terminal qualification and experience is required. J.D.-Ph.D. qualification for Tax/Law instruction also being sought. Rank and salary depend upon qualifications. Send resumé and references to Gary John Previts, Weatherhead School of Management, Case Western Reserve University, Sears Library Building, Room 607, Cleveland, Ohio 44106. Case Western Reserve University is an Affirmative Action, Equal Opportunity Employer.

#106 THE UNIVERSITY OF MANITOBA is seeking applicants for tenure-track positions in accounting for July 1987. Rank and salary open, based on qualifications and experience. A visiting appointment is also possible. Ph.D. or DBA, completed or near completion, is required. Duties include research and teaching at the undergraduate and graduate levels. Salary is competitive and will depend on qualifications, experience and research record. Winnipeg, a multi-cultural city of 600,000, offers the best of an urban environment in the heart of Canada's vacation land. Both women and men are encouraged to apply. In accordance with Canadian immigration requirements, priority will be given to qualified Canadian citizens and permanent residents of Canada. Applications should be sent to: Dr. L. I. Gould, Head, Department of Accounting and Finance, University of Manitoba, Winnipeg, Manitoba R3T 2N2.

#107 SUFFOLK UNIVERSITY, Boston, Massachusetts. The Accounting Department of the School of Management is seeking faculty members to fill tenure-track positions. Teaching will be at the undergraduate/graduate level(s). Primary openings in governmental fund accounting, managerial or financial areas. Qualified candidates should be able to teach in a second accounting area. Evidence of effective teaching, research competence and a strong record of publications required. CPA, CMA, or other certification(s) desirable. Ph.D./DBA in accounting required. Apply to Ronald Sundberg, Associate Dean, School of Management, Suffolk University, Beacon Hill, Boston, MA 02108 or call (617) 723-4700, ext. 307. An equal opportunity, affirmative action employer.

#108 ASSOCIATE PROFESSOR (TAXATION) at a major private institution with respected Master of Taxation program seeks visiting professorship for 1987–88 AND/OR summer teaching for any summer session after 1986. Coastal or resort areas preferred for summer. Areas of expertise are Partnership, Estate and Gift and Fiduciary Taxation. Three years "Big Eight" experience and twelve years teaching experience. Please write for vita.

#109 THE UNIVERSITY OF NORTH CAROLINA AT GREENSBORO is seeking applications for a faculty position in Taxation (Assistant/Associate Professor). Doctorate is desirable, however, doctoral candidates at advanced dissertation stage will be seriously considered. Salary negotiable. Send resumé to Dr. Phyllis A. Webster, Department of Accounting, School of Business and Economics, The University of North Carolina at Greensboro, Greensboro, NC 27412. Call (919) 334-5647. An Equal Opportunity, Affirmative Action Employer.

#110 UNIVERSITY OF NEBRASKA-LINCOLN. Two tenure-leading Assistant Professorships. Will teach classes in Financial Accounting, Managerial Accounting, Auditing and Systems. Will conduct research and provide service in the area of accounting. Ph.D. or DBA required. CPA or CMA desirable. Salary commensurate with experience. Starting date January 1987 or August 1987. Submit letter of application, resumé, and three letters of recommendation to: Search Chair, School of Accountancy, 301 College of Business Administration, University of Nebraska-Lincoln, Lincoln, Nebraska 68588-0400. Affirmative Action/Equal Opportunity Employer.

#111 CLARK UNIVERSITY, Graduate School of Management, invites applications for tenure-track faculty position in ACCOUNTING, starting September 1987. Ph.D./D.B.A. preferred; A.B.D. or M.B.A./CPA considered. Rank, salary, and benefits are competitive and dependent upon qualifications. Teaching load is five sections per year. Publication and professional activities are expected. Clark is a small, quality, private university in Worcester, New England's second largest city (42 miles west of Boston). Application deadline is March 15, 1987. Contact Dr. Richard J. Bartkowski, Assistant Professor of Accounting, Graduate School of Management, Clark University, 950 Main Street, Worcester, MA 01610. Clark University is an Equal Opportunity, Affirmative Action Employer.

#112 POSITION WANTED: MBA/CPA, nine years teaching experience, three years varied accounting experience, some research, excellent teaching record; seeking tenure-track position. Prefer Northeast but will consider other locations. Available January 1987 or after.

#113 UNIVERSITY OF CALIFORNIA, DAVIS, Faculty position in Accounting. One position, rank open, in Accounting, Graduate School of Administration. Duties include graduate instruction, course development, and a high level of research productivity, experience or demonstrated potential in managerial accounting, planning and control systems, or accounting information systems. Ph.D. or equivalent required. Send vita, names and addresses of four references to Gary M. Walton, Dean, Graduate School of Administration, A-2, University of California, Davis, CA 95616. Position open until filled, but to guarantee consideration, applications should be received by January 15, 1987; position available July 1, 1987. The University of California is an Affirmative Action/Equal Opportunity Employer.

#114 ALL POSITIONS, TENURE-TRACK for the 1987-88 year. Minimum qualifications: Ph.D. or DBA in Accounting (ABD considered if dissertation in process). Undergraduate and graduate level teaching. Salary is competitive. Send resumé to: Teddy L. Coe, Department of Accounting, North Texas State University, Denton, Texas 76203. NTSU is an Equal Opportunity, Affirmative Action Employer.

#115 SAN DIEGO STATE UNIVERSITY has three tenure-track openings for Assistant, Associate, and Full Professors in the areas of accounting systems and financial accounting, to begin Fall 1987. If necessary, one-year or multi-year temporary employment may be available. SDSU is an Equal Opportunity/Affirmative Action Employer. Please contact G. E. Whittenburg, Director, School of Accountancy, San Diego State University, San Diego, CA 92182. Telephone (619) 265-5310. A doctorate (or ABD) granted by a university with an AACSB-accredited graduate program is required. CPA/CMA highly desirable. Deadline date is open.

#116 EASTERN ILLINOIS UNIVERSITY. Assistant or Associate Professor of Accounting. Tenure-track position. Ph.D. in Business with accounting major required. Teaching load reduction possible for those researching and publishing. Class assignments are flexible (depending upon program needs), but auditing, governmental, and financial are primary needs. Salary is dependent upon qualifications and experience with net pay being very competitive since Eastern is not under Social Security and the pension plan is tax-sheltered. For further information contact: Dr. Lowell D. Bourne, Chair, Department of Accountancy, Data Processing and Finance, Eastern Illinois University, Charleston, IL 61920; (217) 581-3023. An Affirmative Action/Equal Opportunity Employer.

#117 THE UNIVERSITY OF SOUTH FLORIDA is seeking highly qualified faculty members to teach graduate-level courses in accounting. These positions are at the Associate Professor or Professor rank. Those considering the position must have a demonstrated interest in, and leadership capacity to do, publishable research and a high level of competence in teaching graduate-level courses in the Master of Accountancy and Ph.D. programs. The individual must have experience in the supervision of doctoral dissertations. The University of South Florida is an Affirmative Action/Equal Opportunity Employer. Please send vita to Robert J. West, Chairperson, Department of Accounting/Law, College of Business Administration, University of South Florida, Tampa, Florida 33620.

#118 THE UNIVERSITY OF NORTHERN IOWA, School of Business, Department of Accounting, is seeking candidates for a permanent position in accounting at either the Assistant or Associate level. The candidate should be prepared to teach high-quality M.B.A. students and advanced courses to an unusually motivated group of undergraduates. The School of Business, which includes 58 full-time equivalent faculty members, provides an environment of warm, collegial relationships coupled with a high degree of professionalism. Performance evaluation is based on a blend of good teaching, research, and professional service. The blend is tailormade to fit each faculty member's needs and interests. The university is located in a prosperous metropolitan area of 130,000 with abundant opportunities for executive development and consulting. Salary will be competitive. The University of Northern Iowa is an affirmative action employer. Women and minorities are encouraged to apply. Send current vita to Dr. Gaylon Halverson, Head, Department of Accounting, School of Business, University of Northern Iowa, Cedar Falls, IA 50614.

#119 THE UNIVERSITY OF BALTIMORE invites applications for tenure-track positions in accounting at the Assistant and Associate Professor levels. Applications will be accepted through January 15, 1987, or until the position is committed. Teaching excellence is stressed; research experience, publications, and professional activities required. Applicant must possess the doctorate or equivalent (Ph.D., DBA, LLM/CPA). The University of Baltimore is an upper division, AACSB-accredited institution at the Junior and Senior levels. Forward your resumé to Professor Arthur T. Roberts, Ph.D., C.P.A., Accounting Department, University of Baltimore, Baltimore, MD 21201-5779. The University of Baltimore is an Equal Opportunity/Affirmative Action Employer.

#120 CHAIRPERSON—ACCOUNTING. Department of Accounting, University of Baltimore School of Business. Position requires Ph.D. or D.B.A., publications, administrative skills, and a record of outstanding teaching experience. C.P.A., C.M.A., or C.I.A. preferred. Salary is competitive. The School of Business is AACSB-accredited at the undergraduate level and is seeking graduate accreditation. Applications will be accepted through January 15, 1987 or until the position is committed. Applicants should contact Professor Arthur T. Roberts, Ph.D., C.P.A., Chairman, Search Committee, University of Baltimore, 1420 North Charles Street, Baltimore, Maryland 21201-5779. Equal Opportunity/Affirmative Action Employer.

#121 CANISIUS COLLEGE. Our new MBA Program in Professional Accounting has created two positions in the areas of financial and managerial accounting. We are a private Jesuit College serving western New York. We pride ourselves on the quality of our 4200 students and our strong relationship with the accounting and business community. Applicants should possess a Ph.D. or D.B.A. with a concentration in accounting or be at the advanced stage of their dissertation. Please direct your resumé to Dr. Edward J. Gress, Chairman, Department of Accounting, Canisius College, Buffalo, New York 14208. Canisius College is an Equal Opportunity, Affirmative Action Employer.

#122 JAMES MADISON UNIVERSITY—DIRECTOR, School of Accounting. The Director of the School of Accounting provides academic and administrative leadership for all programs and personnel in a department of 16 full-time and three part-time faculty serving 300 majors. Qualifications include an earned doctorate and substantial publications. Accounting experience and certification desirable. JMU's accounting programs are accredited by the AACSB at the bachelor's and master's levels. For a detailed position announcement or to apply, contact: Jackson E. Ramsey, College of Business, James Madison University, Harrisonburg, VA 22807. (703) 568-6608. Deadline: January 30, 1987. Affirmative Action, Equal Opportunity Employer.

#123 ELON COLLEGE has an open senior level position in financial and managerial accounting. Applicants should have a Ph.D. in accounting (or related discipline), CPA or CMA qualification, teaching experience, and non-academic work experience. The position involves both undergraduate and graduate teaching, leadership in curriculum planning and development, and interaction with the private sector. Rank and salary are negotiable. Elon College is one of North Carolina's foremost private coeducational colleges. Located in the town of Elon College, adjacent to the city of Burlington, the College is situated near Interstate Highway 85, approximately 15 miles east of Greensboro and 30 miles west of the Raleigh-Durham metropolitan area. Send letters of application and resumés to: Martin L. Shotzberger, Director, The Martha and Spencer Love School of Business, Elon College Box 2261, Elon College, NC 27244. Elon College is an Equal Opportunity/Affirmative Action Employer.

#124 CENTRAL MICHIGAN UNIVERSITY has one or more faculty openings for the 1987–88 academic year. While all areas are encouraged to apply, the primary needs are in systems and taxation. Ph.D. or near completion is required, professional certification is desirable. Rank is open depending on qualifications. Competitive salary with excellent benefits. Maximum of nine-hour load per semester; summer teaching and research opportunities available. Excellent working and living environment. Undergraduate business programs are AACSB-accredited. Contact Philip L. Kintzele, Chairman, Department of Accounting, Central Michigan University, Mt. Pleasant, MI 48859. CMU is an Affirmative Action/Equal Opportunity institution; all parties are invited to apply.

#125 JOHNSON GRADUATE SCHOOL OF MANAGEMENT, CORNELL UNIVERSITY. *Job Title*: Assistant, Associate or Full Professor of Accounting. *Job Description*: Responsible for teaching basic and advanced courses in accounting at the Master's level; research in area(s) of expertise and interests; supervision of doctoral candidates; and interdisciplinary contribution to the research and teaching of other faculty members. Direct inquiries to: Professor Dale Morse, Johnson Graduate School of Management, 520 Malott Hall, Cornell University, Ithaca, New York 14853. Applicants should have completed a doctorate or be at the dissertation stage of a doctoral program. Applications should include a vita, and a research paper that the applicant would like to present. An Affirmative Action/Equal Opportunity Employer.

#126 TENURE-TRACK POSITIONS FOR THE 1987-88 ACADEMIC YEAR. Rank and salary depend on academic preparation and experience. Ph.D. or ABD required for tenure-track appointment. Our program includes a five-year Professional Accountancy Program in addition to baccalaureate curriculum. Send letter of application, vita, three (3) letters of reference and transcripts by February 13, 1987 to: Dr. Charles J. Pineno, Chair, Department of Accountancy, College of Business Administration, Clarion University of Pennsylvania, Clarion, PA 16214. Equal Opportunity Employer.

#127 THE STATE UNIVERSITY OF NEW YORK AT BUFFALO has a September 1986 opening for an Assistant or Associate Professor of Accounting. Fields of interest may include financial accounting, managerial accounting, auditing and accounting information systems with teaching opportunities at undergraduate, M.B.A., and Ph.D. levels. Teaching load is six hours per semester. Candidates for an Assistant Professor position should have a strong interest in research and possess relevant research tools and have an earned doctorate or be in the advanced stage of dissertation research by September 1987. Candidates for an Associate Professor position should have a completed doctorate, an established research record, demonstrated teaching ability, and an ability to supervise doctoral students and work with junior faculty. Salary and fringe benefits are competitive. The University is an Affirmative Action/Equal Opportunity Employer. Please send resumé to Professor John C. Gardner, 344 Jacobs Management Center, State University of New York at Buffalo, Buffalo, New York 14260.

#128 ACCOUNTING POSITION. Tenure track and fixed term positions at the assistant/associate professor level beginning September, 1987. Teaching assignment: Combination of lower and upper division accounting courses based upon candidates' coursework and/or teaching experience. Qualifications are: Ph.D. or D.B.A. preferred with masters plus CPA or CMA considered; demonstrated teaching ability and some evidence of professional and/or research capability; several years of full-time undergraduate experience for Associate rank; strong commitment to professional and academic excellence. Positions open until filled but applications received before January 31, 1987 will be given preference. Send letter of application, resumé and three letters of reference. An equal opportunity/affirmative action employer. CONTACT: Andre Corbeau, Dean, School of Business and Economics, Eastern Montana College, Billings, MT 59101-0298.

#129 PROFESSOR OF ACCOUNTING AND DIRECTOR OF THE ACCOUNTING PROGRAM, School of Management, University Center at Binghamton. Nominations and applications are invited for the position of Professor of Accounting and Director of the Accounting Program. An earned doctorate and professional certification are preferred. Candidates should have demonstrated a commitment to excellence in research, teaching and service and also have the ability to work effectively with faculty, students, administrators, business and professional leaders. Applications and nominations will be accepted until March 1, 1987 or until such time as a qualified applicant is accepted. The School of Management at the University Center at Binghamton has, by any measure, excellent students in its BS and MS accounting programs. Nearly 75% of the 600 undergraduate accounting students graduated in the top 10% of their high school class. All "Big 8" recruit annually. An MS program in accounting has been established; a Ph.D. program is being discussed. Please send resumé to: Dean Thomas Kelly, School of Management, SUNY-Binghamton, Binghamton, NY 13901. Telephone no. (607) 777-2314.

#130 BOWLING GREEN STATE UNIVERSITY is seeking applicants for tenure-track positions (associate or assistant) and term instructors in accounting or management information systems, starting January 1987 or August 1987. Requirements for the tenure-track positions are a Ph.D. or equivalent (or an advanced-stage ABD at the assistant level) and a commitment to research and teaching. Applicants for instructor should hold an appropriate master's degree. The CPA, CMA, or CIA certificate is desirable for accounting applicants. The University, a state-supported institution with an enrollment of 16,000, is located 25 miles south of Toledo. Applications and inquiries should be directed to Professor Thomas G. Evans, Chair, Department of Accounting and Management Information Systems, Bowling Green State University, Bowling Green, OH 43403. Bowling Green is an Equal Opportunity/Affirmative Action Employer.

#131 CALIFORNIA STATE UNIVERSITY, NORTHRIDGE (situated in the northwest corner of the City of Los Angeles), anticipates full-time faculty openings at the ranks of Professor and Lecturer for the academic year 1987-88. The Department offers BS and MS degree options in both Accounting Theory and Practice and MIS. Knowledge of microcomputer applications preferred.

Doctorate in Accounting required for tenure and promotion. CPA or CMA certificate desired. Salary level $23,400-$53,000, commensurate with qualifications and experience. Opportunity to earn an extra $14,000 teaching Summer School. We are an equal opportunity/affirmative action, Title IX, Section 504 employer. Address inquiries to: Donald L. Raun, Department Chairman, Department of Accounting and MIS, School of Business, CSUN, Northridge, CA 91330. Application deadline: January 15, 1987, or until positions are filled.

#132 ACCOUNTING DEPARTMENT. Indiana University of Pennsylvania invites applications for several tenure-track positions in the Accounting Department, College of Business, beginning the Fall Semester 1987. Qualifications are a Ph.D. or DBA or candidate actively pursuing the doctorate. Candidates holding a masters degree and professional certification (CPA and/or CMA) will be considered for a temporary appointment. Scholarly activity is encouraged by giving teaching load reduction to engage in such activities. Salary is competitive, plus excellent fringe benefits. Send letter of application along with resumé, transcripts and three letters of reference to: Dr. Dennis D. Tiger, Chairperson, Faculty Selection Committee, Department of Accounting, Indiana University of Pennsylvania, Indiana, PA 15705. Initial screening will begin on January 15, 1987. Applications will be accepted until positions are filled. IUP is an affirmative action/equal opportunity employer.

#133 THE UNIVERSITY OF MARYLAND European and Asian Divisions seek excellent teachers for undergraduate courses on U.S. military bases overseas. Minimum requirements include a master's in accounting, one year of recent college teaching experience, and U.S. citizenship. Renewable annual appointments begin August 1987. Excellent for a sabbatical or leave of absence. Benefits include transportation and military base privileges. Frequent travel and the cost of schooling make these positions difficult for those with children. Send resumé to Dr. Lois A. Mohr, The University of Maryland University College, College Park, MD 20742-1642. AA/EEO.

#134 NORTHEASTERN ILLINOIS UNIVERSITY has tenure track positions at Assistant/Associate rank available in January or September 1987 in the areas of: Financial Accounting, Management Information Systems, and Cost/Managerial Accounting. Ph.D./D.B.A. in Accounting preferred; candidates at the final dissertation stages are encouraged to apply. Research support in the form of release time for publications is available. Teaching experience preferred. Candidate must have commitment to research. Selection process begins November 15, 1986 and continues until filled. Northeastern Illinois University is a state supported institution of approximately 11,000 students. The University is an equal opportunity/affirmative action employer. Please send resumé, transcripts, and letters of reference to: Dr. Olga E. Engelhardt, Dean, College of Business and Management, Northeastern Illinois University, 5500 N. St. Louis, Chicago, Illinois 60625.

#135 GRAND VALLEY STATE COLLEGE—THE ACCOUNTING AND TAXATION DEPARTMENT is seeking applications for faculty positions to teach at the undergraduate and graduate levels. ACCOUNTING. Rank is dependent upon qualifications. Salary range is competitive. Excellent fringe benefits, research monies, and summer teaching opportunities. Degree requirements are doctorate for rank of Associate or Full Professor; MBA and CPA or CMA minimum qualifications for rank of Assistant Professor. Some teaching experience, research and publication interests. TAXATION. Rank is open. Position opening date is September 1987. Salary range is competitive. Excellent fringe benefits, research monies, and summer teaching opportunities. Degree requirements are Doctorate or LLM in taxation and CPA or CMA or JD and a Master's degree with a concentration in taxation. Some teaching experience, research and publication interest. Please send a vita to Dr. Donald J. Klein, CPA, CMA, Chairman, Department of Accounting and Taxation, Seidman School of Business, 244 Lake Huron Hall, GRAND VALLEY STATE COLLEGE, Allendale, MI 49401 or call (616) 895-3655. Grand Valley is an Equal Opportunity and Affirmative Action Employer.

#136 TEN YEARS EXPERIENCE teaching Accounting, Finance, Business (also Economics). 2 or 4 year college, available January, 1987. Call 518-561-0338.

#137 RENSSELAER POLYTECHNIC INSTITUTE, School of Management, has two tenure-track faculty openings in accounting/finance at the Assistant/Associate Professor level for 1987-88. RPI is a research-oriented school with undergraduate, MBA, and doctoral programs, with concentrations in accounting. PhD's preferred but ABD's will be considered. Interested applicants should send resumés and other materials to: Professor David Goldenberg, School of Management, Rensselaer Polytechnic Institute, Troy, NY 11180. RPI is an Affirmative Action/Equal Opportunity Employer.

#138 THE UNIVERSITY OF WISCONSIN-PARKSIDE invites applications for a tenure-track position in Accounting, at the Assistant or Associate Professor level, starting in August 1987. Candidates should have appropriate doctorate (ABD will be considered) and a commitment to teaching and research. Teaching responsibilities include graduate and undergraduate accounting courses. Salary is competitive and commensurate with qualifications and experience. The University is located about thirty miles south of Milwaukee. Applications accepted until position is filled. Send resumé and three references to Dr. Arthur L. Dudycha, Chairperson, Division of Business and Administrative Science, Box No. 2000, Kenosha, WI 53141-2000. An equal opportunity/affirmative action employer.

#139 UNIVERSITY OF MISSOURI-ST. LOUIS has tenure-track positions; rank and salary dependent on qualifications. Most interest areas can be accommodated though candidates in cost/managerial, financial, governmental, international or systems preferred. Quality research and teaching expected. Candidates should possess Ph.D./DBA. Professional certification desirable. ABDs considered for junior position. Senior appointment requires strong publication record. UMSL enrolls over 3,000 students in AACSB-accredited undergraduate and masters business programs. Pleasant suburban location. Submit resumé or inquiries to David R. Ganz, Coordinator, Accounting Area, University of Missouri-St. Louis, 8001 Natural Bridge Road, St. Louis, Missouri 63121-4499 (an affirmative action, equal opportunity institution).

#140 FACULTY POSITIONS—SUNY COLLEGE AT NEW PALTZ DEPARTMENT OF BUSINESS ADMINISTRATION. Tenure track and visiting positions at the rank of assistant professor in all areas of accounting. Ph.D's preferred, ABD's will be considered at the rank of lecturer as will MS/CPA's or MBA/CPA's. The SUNY College at New Paltz is ideally located on a beautiful campus 75 miles north of New York City in a picturesque area at the foothills of the Catskill Mountains. The College has a student body of 7,600 students including 600 business majors. We are actively seeking minority and women applicants. Our selection procedure will begin in late January. Please send a letter explaining professional qualifications for the position; a professional resumé; and names, addresses and telephone numbers of three professional references to: Donald Bishko, Chair, Department of Business Administration, Box 10, State University College, New Paltz, New York 12561. SUNY New Paltz is an equal opportunity affirmative action employer.

#141 THE DEPARTMENT OF ACCOUNTING at the University of Idaho invites applications for tenure-track faculty position for an assistant or associate professor of Accounting in the areas of financial and/or managerial accounting. Ph.D. or DBA in accounting is required. Applicants are expected to have a commitment to teaching, research and service. Professional certification desirable. ABD's will be considered. Qualified candidates should send a letter of application and a resumé to: Jeffrey L. Harkins, Department of Accounting, University of Idaho, Moscow, ID 83843, or call 208-885-6453. Review of applicants' credentials will begin on January 1, 1987 and application materials received after that date may not be considered. The UI is an EO/AA employer.

#142 CATAWBA COLLEGE has a tenure-track position in accounting for the 1987-88 academic year. Rank and salary are open depending upon qualifications. Candidates with a doctoral degree are preferred. Managerial experience in industry is a major plus. Executive education experience is helpful. Candidates must have a desire to be innovative, non-traditional, and experiential in their educational and research thrusts. An interest in entrepreneurship/small business is appreciated. For additional information, contact: Dr. Douglas W. Schell, Ketner School of Business, Catawba College, Salisbury, North Carolina 28144. Catawba College is an equal opportunity/affirmative action employer.

#143 CHAIRPERSON, THE UNIVERSITY OF TOLEDO. The Department of Accounting invites nominations and applications for the departmental chairperson. Candidates should possess a doctorate, preferably with accounting as a major area of study. Applicants should have established credentials sufficient to support a senior level faculty appointment. Salary for the appointment is very competitive. The University of Toledo has an enrollment of approximately 20,000 students. The campus is located in an excellent neighborhood which enables many of the faculty to walk to their offices. The Accounting Department offers an undergraduate degree in accounting, as well as a Master of Science in Accounting degree and the MBA. Send vita to Dr. Larry F. Konrath, Chairman, Department of Accounting, The University of Toledo, Toledo, Ohio 43606. The University of Toledo is an Equal Opportunity/Affirmative Action Employer.

#144 THE UNIVERSITY OF TOLEDO, DEPARTMENT OF ACCOUNTING, invites applications for positions in auditing, information systems, and taxation effective September, 1987. Candidates should possess a doctorate with a specialty in accounting. Persons holding the combination of JD, MBA, CPA will also be considered for the tax position. Salary is very competitive. The University of Toledo has an enrollment of approximately 20,000 students. The campus is located in an excellent neighborhood which enables many of the faculty to walk to their offices. The Accounting Department offers an undergraduate degree in accounting, as well as a Master of Science in Accounting degree and the MBA. Send vita to Dr. Larry F. Konrath, Chairman, Department of Accounting, The University of Toledo, Toledo, Ohio 43606. The University of Toledo is an Equal Opportunity/Affirmative Action Employer.

#145 INSEAD—THE EUROPEAN INSTITUTE OF BUSINESS ADMINISTRATION is seeking to expand its accounting and control faculty. Expansion is required to meet the growing demands of MBA and executive programmes and to respond to research opportunities. Career and visiting positions are available at all ranks. Conditions of employment are competitive and negotiable. There is a tenure system for senior faculty. Successful candidates will have or be completing a Ph.D. (or equivalent), be managerial in orientation, enjoy teaching MBA's and executives, use microcomputers in their courses and be active in positive accounting research. The primary language of instruction is English. Reply to: Deigan Morris, Area Coordinator, Accounting and Control Area, Insead, Boulevard de Constance, 77305, Fontainebleau Cedex, France.

#146 WAKE FOREST UNIVERSITY'S BABCOCK GRADUATE SCHOOL OF MANAGEMENT seeks a PhD with an applied orientation, demonstrated teaching competence, and the capacity to contribute to the development of managerial thought for a new, tenure track, junior appointment in accounting. The school offers the MBA non-degree executive education. The school's environment is characterized by close student, faculty and business community interaction. There is strong commitment to teaching excellence and the preparation of individuals to manage effectively in an information rich, "global village" environment. Generous resources are available for faculty development and research. Please contact James M. Clapper, Associate Dean, Babcock Graduate School of Management, Wake Forest University, Winston-Salem, North Carolina, 27109.

#147 MARQUETTE UNIVERSITY seeks applicants for Assistant Professorship in financial accounting and auditing. Ph.D. or D.B.A. preferred, but ABD's in final stages are considered. Competitive salary and research support, and excellent fringe benefits. Teaching at undergraduate and graduate levels available. Research is expected. Marquette University is an equal opportunity/affirmative action employer. Search is open until position is filled. Interested persons should submit resumés including professional and educational background, publications, teaching interests, and personal data (and a dissertation abstract or proposal if applicable). Apply to: Dr. Don E. Giacomino, Chairman, Accounting Department 303A, Straz Hall, Marquette University, Milwaukee, WI 53233, or phone (414) 224-5669.

#148 THE UNIVERSITY OF NEBRASKA AT OMAHA invites applications and nominations for the Department of Professional Accounting Chairperson, beginning Summer-Fall 1987. Applicants must possess an earned doctorate and must have evidence of a strong post-doctoral record of teaching, scholarly research and publication, and professional activities appropriate for an appointment at the Associate or Full Professor rank. The closing date of the search is February 20, 1987. Nominations and applications should be sent to: Dr. Larry Trussell, Dean, College of Business Administration, University of Nebraska at Omaha, Omaha, Nebraska 68182-0048. An Equal Opportunity, Affirmative Action Employer.

#149 ASSISTANT/ASSOCIATE PROFESSOR, SCHOOL OF BUSINESS AND ENGINEERING ADMINISTRATION, MICHIGAN TECHNOLOGICAL UNIVERSITY. Applications are invited for the positions of Assistant Professor and Associate Professor of Accounting at Michigan Technological University. MTU is a state-supported University with an enrollment of 6300 students. It is a technologically-oriented institution with strong programs and excellent students in business, engineering, forestry and science. The School of Business and Engineering Administration currently enrolls approximately 350 students and offers the baccalaureate degrees in business administration, engineering administration, and economics, as well as the Master of Science in Mineral Economics, and Operations Management. Candidates should hold an earned doctorate in Accounting. Candidates at the all-but-dissertation stage of their doctoral programs are also invited to apply. Professional certification and/or relevant professional experience is desired. The successful candidate will teach his or her specialty at the under-graduate and graduate levels. The normal teaching load is nine hours per quarter with release time available for significant research activities. Summer quarter teaching and research opportunities are available. The salary will be competitive. Applications and inquiries should be sent to: William B. Chapel, Chair, Recruiting Committee, School of Business and Engineering Administration, Michigan Technological University, Houghton, MI 49931. Michigan Technological University is an Equal Opportunity Educational Institution/Equal Opportunity Employer.

#150 Ph.D. (1986), CPA seeks position with AACSB-accredited university in mid or southwest where quality teaching (undergraduate and graduate) is emphasized and where professional activities (including research) are encouraged and supported. Thirteen years teaching experience. Primary area financial but have taught auditing and cost. Available fall 1987.

#151 POSITION WANTED: D.B.A. in Accounting; C.P.A. Several years of both teaching and business experience. Seek position with smaller, quality oriented university which appreciates and supports good teaching, research and professional involvement. Available August, 1987.

#152 "——, POSITION WANTED. MA in Accounting, CPA. Seek teaching position. Prefer location at or near school in which a doctoral program is available but will consider other locations. Prior teaching experience with outstanding student evaluations. Three years varied accounting experience including position as Controller of major hospital corporation. GPA: overall 3.7; 3.8 in accounting. Excellent recommendations. Will respond to all inquiries. Available January 1987 or Summer or Fall 1987."

#153 GEORGETOWN UNIVERSITY, Washington, D.C. The School of Business Administration invites applications for a tenure-track position in accounting for Fall, 1987. Candidates should have a strong commitment to excellence in teaching and research. Salary and fringe benefits are competitive. The School of Business Administration offers the B.S.B.A. degree, with a concentration in Accounting. On the graduate level, Georgetown University offers programs leading to the degrees of Master of Business Administration and Master of Science in Taxation. Georgetown University is an equal opportunity/affirmative action employer. Please send resumé and references to: Virginia N. Flavin, Director of Faculty Services, School of Business Administration, Georgetown University, Washington, D.C. 20057.

#154 DREXEL UNIVERSITY, DEPARTMENT OF ACCOUNTING invites applications for a tenure-track faculty position at the Associate or Full Professor level in the area of financial accounting beginning Fall 1987. Principal Qualifications: (1) Terminal degree (Ph.D. or DBA); (2) Demonstrated interest in and capacity to do publishable research and a high level of competence in classes for MBA's and Ph.D.'s; (3) Full Professor must have established record of teaching and research with demonstrated competence in directing doctoral theses. Salary competitive. Please send resumés and references to: Dr. Cadambi A. Srinivasan, Head, Department of Accounting, Drexel University, Philadelphia, PA. 19104. Telephone (215) 895-2116. Drexel University is an Equal Opportunity/Affirmative Action Employer.

#155 POSITION WANTED—MBA, CPA, CMA, Ph.D. (Physics), seeks Fall 1987 tenure-track position in a strong institution which emphasizes and rewards good teaching. Experience includes teaching (currently associate professor) and academic administration. Teaching experience includes most financial and managerial areas.

#156 ACCOUNTANT—A unique career opportunity now exists on the professional staff of the Institute of Certified Management Accountants (ICMA). The responsibilities of this positions entail developing material for the CMA examinations, participating in grading administration of the CMA examination, and promoting the CMA program. The successful candidate will possess a Graduate Degree (Accounting Major at undergraduate or graduate level), Management Accounting and/or college teaching experience, computer experience (primarily analysis on a PC), and professional certification (CMA preferred). This position is available immediately. Interested candidates should submit a detailed resumé, including salary history, to: Dr. Karl E. Reichardt, Institute of Certified Management Accountants, 10 Paragon Drive, Montvale NJ 07645-1759.

#157 CALIFORNIA STATE UNIVERSITY, FULLERTON, invites applications for Chair, Department of Accounting. Business Administration programs accredited by AACSB. Graduate programs:

MBA, M.S. Taxation, M.S. Accountancy. Department has 21 full-time faculty and 800 majors. Chair participates in all personnel decisions and instructional matters; acts as liaison between the university and business. CSUF is in beautiful Orange County, near beaches, and mountains; year-round mild climate. Business community supports our programs; consulting opportunities excellent. Accounting doctorate required. Strong record of research and publication in recognized journals is essential. Contact: A. Jay Hirsch, Department of Accounting, CSUF, Fullerton, CA 92634 (714) 773-2225. Application review begins January 15, 1987. CSUF is AA/EEO employer.

#158 POSITION WANTED: Ph.D. (1972), CPA; 17 years of teaching experience; some publication; desire position to teach financial, cost/managerial accounting, or taxation in a school with a commitment to a high quality program and to teaching excellence.

#159 GEORGIA SOUTHERN COLLEGE invites applications for a one-year appointment as Instructor, Assistant Professor, or Visiting Professor of Accounting for the 1987-88 academic year. Minimum qualifications include an MS in accounting or MBA with an accounting concentration. Professional certification, professional experience, and teaching experience are highly desirable. The primary responsibility is teaching the principles of accounting sequence. The application deadline is March 1, 1987. Send letter of application and vita to: Dr. William Bostwick, Department of Accounting, L.B. 8141, Georgia Southern College, Statesboro, GA 30460. GSC is an Affirmative Action/Equal Opportunity Employer.

#160 TRENTON STATE COLLEGE, ACCOUNTING FACULTY POSITION, SEPTEMBER, 1987. Tenure track position available. Ph.D. required for tenure; doctoral candidates invited to apply. The department has 240 majors and is recognized for superior teaching. Competitive salary, reduced first-year teaching loads and research support available. Resumés accepted until February 1, 1987 or until position is filled. Apply to: Barbara Shiasappa, Chairperson, Department of Accounting, School of Business, CN4700, Hillwood Lakes, Trenton, NJ 08650-4700. Minorities and women are encouraged to apply. AA/EOE.

#161 ST. JOHN FISHER COLLEGE, ROCHESTER, NEW YORK, has two tenure track positions in accounting starting in the Fall of 1987. The minimum requirements are: MBA/CPA or CMA, with significant experience in public or industrial accounting. A Ph.D. or DBA is preferred. Rank and salary depends upon qualifications. St. John Fisher College is an independent, liberal arts college with a strong reputation in the accounting community, offering B.S. and MBA degrees. Send resumés and names of three references to Professor Arthur Hintz, Accounting Chairman, St. John Fisher College, Rochester, New York 14618. EOE.

#162 IDAHO STATE UNIVERSITY has openings for tenure-track Accounting faculty positions at the Assistant/Associate Professor level which will become available during the 1987-88 academic year. Most interest areas can be accommodated, although preference will be given to candidates in finance, management, and auditing. Candidates should hold a doctorate or have substantially completed the degree requirements. Salary compensation is competitive. Research leading to publication and professional activity is expected and rewarded. Situated in Southeast Idaho, ISU offers a remarkable combination of academic excellence, relaxed life style, and superb outdoor recreational opportunities. Send letters of application and resumés to Ronald D. Balsley, Acting Dean, College of Business, Box 8020, Idaho State University, Pocatello, Idaho 83209. ISU is an affirmative action, equal opportunity employer.

#163 CHAIR, Department of Accounting & Management Science, California State University, Chico, starting Fall 1987. Candidates should have a doctorate in accounting and be qualified for appointment as full professor. The Chair is expected to provide leadership to a 24-person department faculty offering a full complement of courses in accounting, management information systems, and management science. The College of Business, one of nine academic units within the university, is fully accredited by the AACSB. The department offers programs and courses in accounting, management science, and management information systems leading to B.S., M.B.A., and M.S. in Accounting degrees. Candidates should have a proven record in teaching, research and service and have the ability to work with professionals in practice and industry. Interested persons should send their resumé and at least five references (name, address and telephone number) to Dr. Karl Brugger, Department of Accounting & Management Science, College of Business, California State University, Chico, Chico, CA 95929-0011. Affirmative Action Employer.

#164 CALIFORNIA STATE UNIVERSITY, HAYWARD seeks applicants for tenure-track faculty positions in accounting and management information systems beginning Fall 1987. Ph.D. (or A.B.D. near completion) required. Assistant Professor positions in financial, managerial, cost, auditing, tax and management information systems. July 1, 1986 salary ranges for nine months: Assistant Professor—$31,488 to $37,872, Associate Professor—$36,072 to $43,476, Full Professor —$44,352 to $53,508. Teaching assignments will include instruction at the undergraduate and/or graduate levels in a department that has an excellent reputation. Hayward, located across the Bay from San Francisco, has attractive residential areas. There are ample opportunities for research and consulting with business and other entities in this diversified metropolitan community. Qualified candidates should send letters of application and resumés to Wade A. Morehouse, Chair, Department of Accounting, California State University, Hayward, Hayward, California 94542. An affirmative action, equal opportunity employer.

#165 CHAIR, Accounting and Information Systems Department, College of Business, Eastern New Mexico University. A chance to get out of metro areas and have access to major recreational areas in and around New Mexico. Candidates must provide academic and recruiting leadership and interact with the business community. Candidates should be tenurable and salary and rank open. Send resumé or call Barry Knight, College of Business, Eastern New Mexico University, Portales, New Mexico 88130, (505) 562-2345. Regular Accounting and Information Systems faculty positions also available.

#166 PEAT MARWICK PROFESSORSHIP, LOUISIANA STATE UNIVERSITY. The LSU Department of Accounting invites applications or nominations for the Peat Marwick Professorship which is available starting in August 1987. The successful candidate will hold a doctoral degree, preferably will be certified, have an expertise in auditing (first preference) or financial accounting, have an excellent research record and have experience working with doctoral students in seminars and on dissertation committees. The successful candidate will be expected to teach 3 to 6 hours per semester and be actively involved in research and publications. Salary is competitive. LSU is an Equal Opportunity/Affirmative Action Employer. Please send applications/nominations to: Vincent C. Brenner, Chairman and Accounting Alumni Distinguished Professor, Department of Accounting, 3101 CEBA Bldg., Louisiana State University, Baton Rouge, LA 70803.

#167 AMERICAN UNIVERSITY, WASHINGTON, D.C., has a tenure-track position for a terminally qualified person with a Ph.D. or DBA with a systems/auditing orientation. Interest in International Accounting desired. Accounting Department has 13 full-time faculty. Good teaching and professional involvement are essential. Salary and benefits competitive. Excellent research and professional opportunities in D.C. Contact: Philip Jacoby, KCBA, American University, Washington, D.C. 20016. EEO/AA.

#168 UNIVERSITY OF ILLINOIS, Department of Accountancy, invites applications at all ranks in accounting. Candidates are expected to possess a doctoral degree or be near completion of degree and should be dedicated to excellence in teaching and research. The University of Illinois is an equal opportunity, affirmative action employer. Please send vita to Recruiting Committee, Chair, Department of Accountancy, University of Illinois, 360 Commerce West, 1206 S. Sixth Street, Champaign, IL 61820. Telephone (217) 333-2451.

#169 WIDENER UNIVERSITY has two September 1987 openings for tenure-track accounting faculty. Ph.D.'s are preferred, but will consider those with substantial progress toward Ph.D. Rank and compensation will depend on education and experience. Salary scale is competitive. Areas of interest are financial and managerial accounting and accounting information systems. Research interest essential. The Accounting Department has eight full-time faculty members and serves about 300 undergraduate and 190 graduate majors. The normal semester course load is 12 credits (9 undergraduate, 3 graduate). Widener University, conveniently located between Philadelphia and Wilmington, Delaware, offers B.S. and M.S. degrees in accounting, an M.S. in taxation and an MBA program. Write to Professor Martin Gage, Chairman, Accounting Department, Widener University, Chester, PA 19013.

#170 MANCHESTER COLLEGE has tenure-track positions starting September 1987: teach undergraduate accounting classes and help with development of five-year program. Master's and professional accounting certification or equivalent required, doctorate in accounting preferred, business experience desirable. Candidates should be comfortable with and contribute to the mission of a church-related liberal arts college dedicated to quality teaching and total student development. Arthur Gilbert, Chair, Department of Accounting, Manchester College, North Manchester, IN 46962.

#171 ASSISTANT/ASSOCIATE PROFESSOR position available in accounting. Ph.D., and, for Associate Professor, strong publication record is essential. Research orientation essential. Teach MBA and U.G. courses in metropolitan Philadelphia area close to beaches and mountains. Salary very competitive. Send resumé to Dr. Rick Elam, Dean, Faculty of Business Studies, Rutgers University, Camden, New Jersey 08102.

#172 CALIFORNIA POLYTECHNIC STATE UNIVERSITY—SAN LUIS OBISPO seeks candidates for Fall 1987 appointments in tenure-track faculty positions with primary teaching interests in managerial and financial accounting. Doctorate with major in accounting required. Practical experience and professional certification preferred. Candidates must be committed to teaching excellence and professional development including research, publication, and professional service. Teaching responsibilities include the undergraduate and MBA programs. Rank and salary commensurate with experience. Fourteen member accounting faculty; 400 outstanding students from top ranks of California high school graduates; small class sizes. Approximately 75 percent of graduates go into public accounting. Department enjoys strong support by alumni and accounting profession. Scenic central coast offers outstanding climate year-round with close proximity to beaches, mountains, and wine country. Half day's travel to L.A., San Francisco, and Sierras. Contact Dr. William C. Boynton, Accounting Department, School of Business, California Polytechnic State University, San Luis Obispo, CA 93407. Closing date: February 15, 1987. Cal Poly is an equal opportunity/affirmative action employer.

#173 UNIVERSITY OF SOUTH CAROLINA AT SPARTANBURG: Tenure track positions in financial and managerial accounting. Doctorate required. Teaching experience with CPA or CMA; commitment to quality teaching. Publication record required appropriate to rank. Salary AACSB-competitive. USCS is near the Blue Ridge Mountains yet convenient to Myrtle Beach. Spartanburg is in the industrial center of the state with over 100 foreign national firms and major textile manufacturing presence. USCS is an affirmative action/equal opportunity employer. Send vita to: Dean Jerry Bennett, School of Business Administration and Economics, University of South Carolina at Spartanburg, Spartanburg, SC 29303.

#174 VISITING POSITIONS, UNIVERSITY OF UTAH. The School of Accounting of the University of Utah invites faculty for visiting positions during the 1987-88 academic year. The School offers undergraduate, master of professional accounting, and Ph.D. degrees. The faculty is committed to both excellence in teaching and research. Weekly faculty research seminars held. Salt Lake City is a central location for a variety of excellent outdoor activities with ski areas located only 26 miles from the city. Contact Dr. Rodney J. Redding, Director, School of Accounting, University of Utah, Salt Lake City, UT 84112. Minority and women faculty are encouraged to visit with us.

#175 ACCOUNTING. Two full-time tenure track accounting positions available Fall 1987. Earned doctorate with sound record of research and publication required. Primary consideration given to those persons whose teaching and research interests include auditing, cost, or accounting systems. Teaching load reductions possible for research. Rank and salary dependent upon qualifications and publication record. Salary competitive with similar AACSB institutions. Send applications and inquiries to Office of Academic Affairs, Accounting Search, Western Kentucky University, Bowling Green, KY 42101. Applications will be accepted until position is filled. Women and minorities encouraged to apply. An Affirmative Action, Equal Opportunity Employer.

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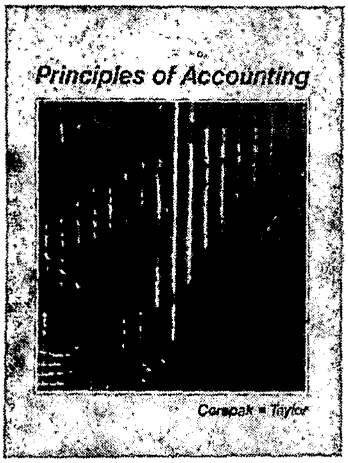

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For additional information please contact:

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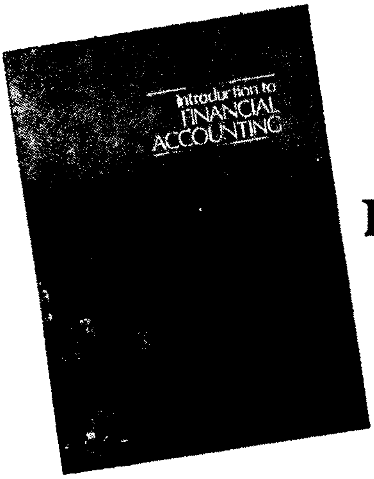

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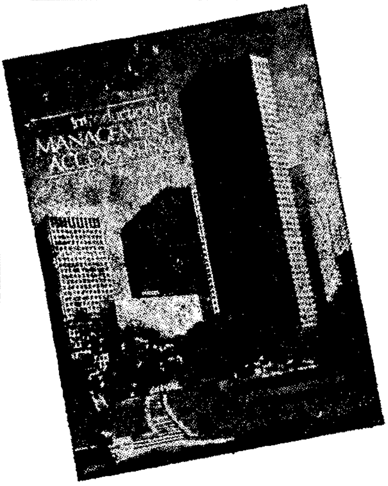

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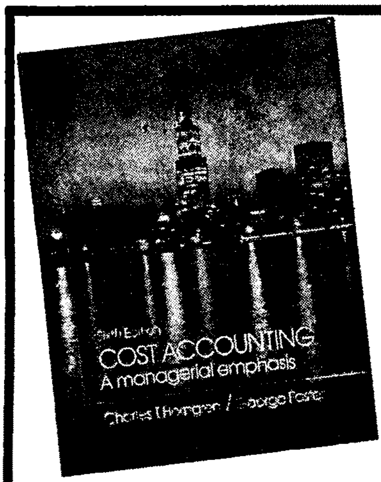

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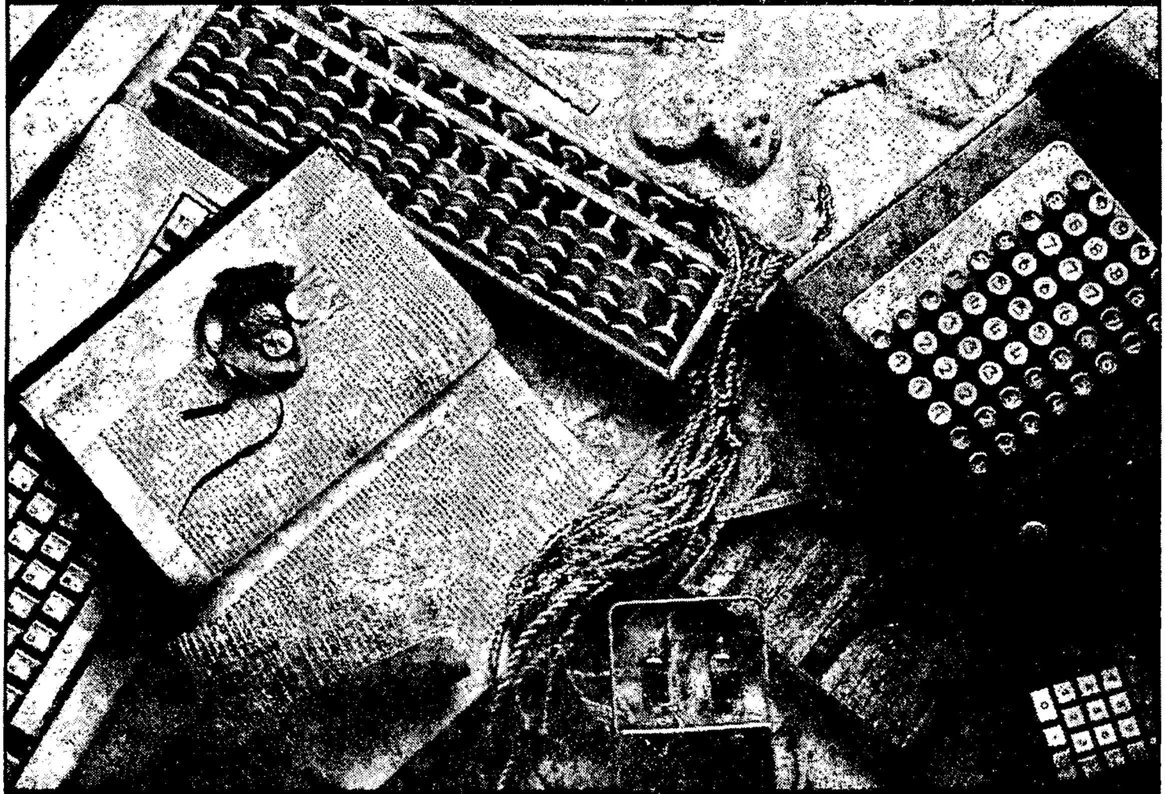

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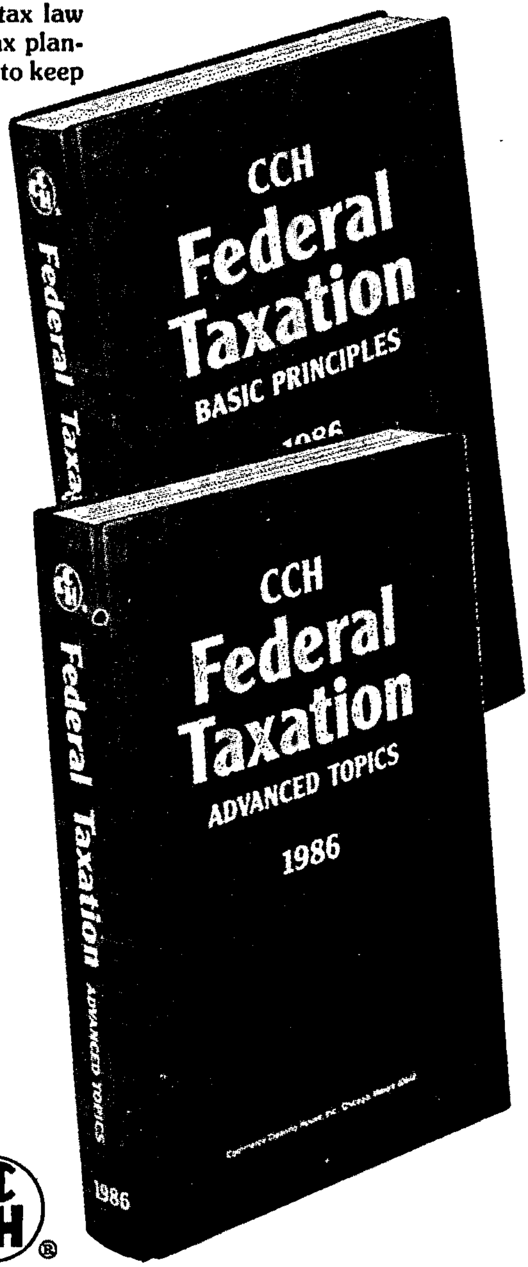

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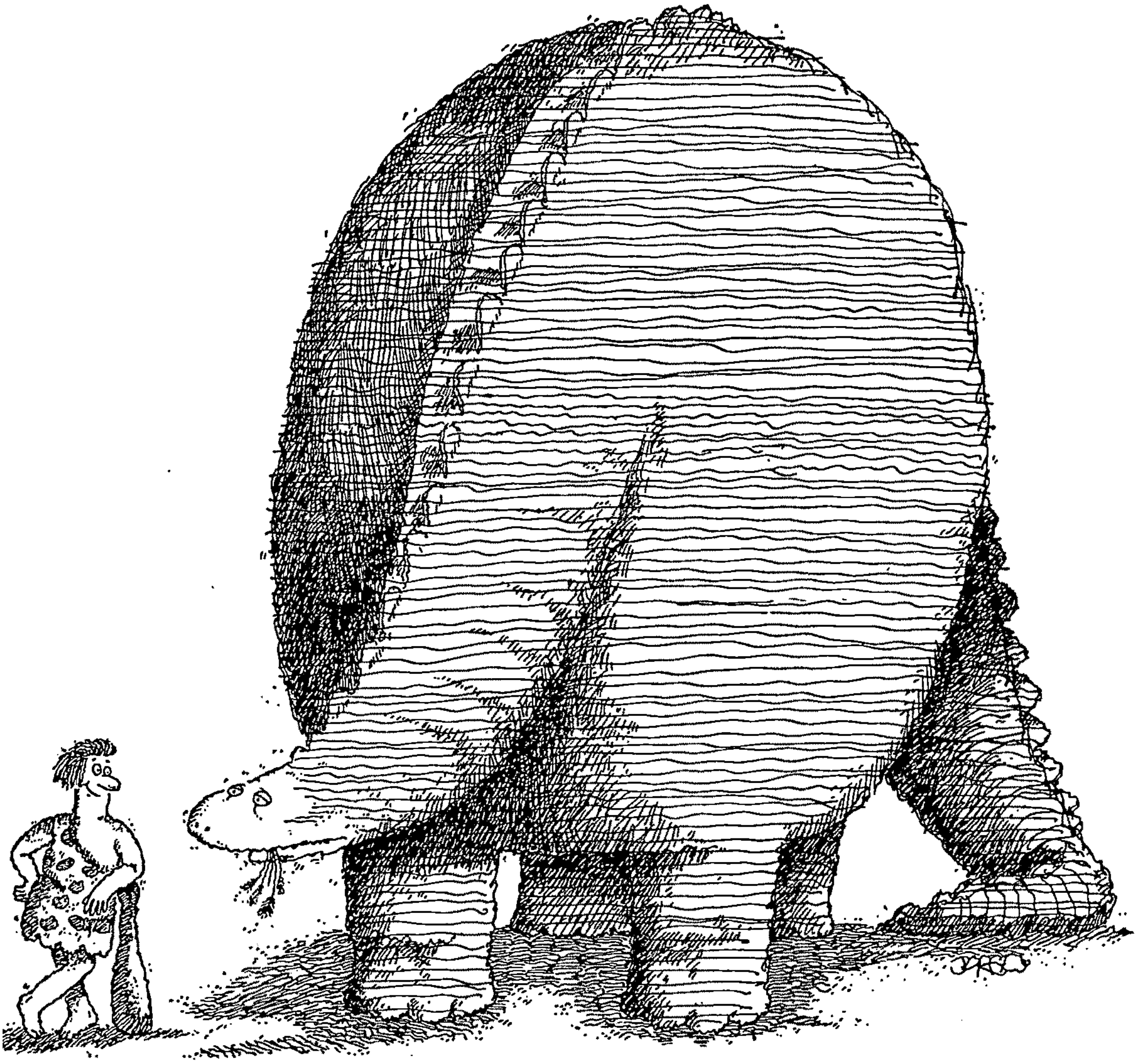

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Auditors' Covariation Judgments

William S. Waller and William L. Felix, Jr.

ABSTRACT: When making audit judgments and decisions, an auditor often relies on knowledge or information about how task variables covary. Typically, an auditor generates this information without the aid of a formal covariation model. Thus, the quality of audit judgments and decisions which rely on covariation information may depend on an auditor's ability to judge covariation in a manner that is paramorphic to a formal model. This paper reports two experiments examining the rules by which auditors integrate joint frequency data when making covariation judgments and whether their judgments are affected by context, prior expectations, and amount of auditing experience. A main result was that the subjects generally used data-integration rules that were sensitive to the objective covariation level, but often overstated or understated this level. The effects of context, prior expectations, and amount of auditing experience were generally small.

An audit opinion formulation process consists of many decomposed judgments and decisions that use a variety of information [Felix and Kinney, 1982]. Frequently, these judgments and decisions require the use of information about how task variables covary [Waller and Felix, 1984a and 1984b]. For example, when deciding whether to perform an audit, an auditor must know which factors (a client's financial position, accounting personnel, and so on) covary with audit problems and determine whether those factors are present in a given case. During audit planning, trade-offs between compliance and substantive tests require knowing how internal control attributes and the presence/absence of material financial statement errors covary. Conversely, an auditor often uses information about independence between variables, as in analytical review, where efficiency and effectiveness require knowing which variables to ignore, as well as which to heed, when forming expectations about audit values.[1]

Sometimes, accurate covariation information is available to an auditor through applications of formal models, as in statistical analytical review. More typically, an auditor generates the required covariation information without using such a model, relying instead

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[1] On a different level, to form an accurate self-perception of judgment ability, an auditor must know how his or her judgments covary with the true state/outcome of the object/event being judged [Waller and Felix, 1984c].

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on experience and perhaps training. In the latter cases, the quality of consequent judgments and decisions may depend on an auditor's ability to judge covariation in a manner that is paramorphic to a formal covariation model. Even when the opinion formulation process taken as a whole is sufficient to counteract the effects of inaccurate covariation information (i.e., audit effectiveness is not impaired), audit efficiency may still suffer.

There is a voluminous literature in psychology on the issues of how and how well individuals judge covariation between binary variables (for reviews, see Nisbett and Ross [1980], Crocker [1981], Lipe [1982], Shaklee [1983], and Alloy and Tabachnik [1984]).[2] On the descriptive issue, there is general agreement that human covariation judgments depend primarily upon three interrelated factors: heeded joint frequency data, rules for integrating the data, and prior expectations about the covariation of interest. On the normative issue, while there is less consensus, the weight of the evidence indicates that human covariation judgments are inaccurate under many conditions.

Auditors' covariation judgments may be similarly prone to inaccuracy, with associated costs in terms of audit efficiency and effectiveness. But any such conclusion must be reached through new empirical investigations in auditing contexts rather than direct extrapolation from the psychological research. Three factors argue against direct extrapolation. First, due to self-selection, training, and experience, auditors are likely to have better general skills for analyzing and inferring relations from data than most subjects in psychological experiments. Second, auditors must meet professional standards under competitive conditions, which provide incentives for auditors to be accurate. Third, subjects in the prior studies typically did not make covariation judgments in a context that involved their substantive expertise or experience.

The purpose of this paper is to determine whether auditors' covariation judgments are prone to the inaccuracies observed in psychological studies. Specifically, the paper reports the results of two complementary experiments on auditors' covariation judgments. In the first experiment, auditors made covariation judgments for self-generated joint frequencies in each of four contexts that were varied to induce changes in the subjects' expectations about the covariation of interest. The context variables involved clients' financial quality and size/diversification. The following questions were addressed. Do auditors correctly integrate their knowledge of audit event co-occurrences? Is covariation judgment accuracy affected by changes in context and, presumably, expectations? What is the association between the amount of auditing experience and covariation judgment accuracy?

The method of the first experiment has the advantage of minimizing artificiality in the heeded data, since the subjects themselves generated the joint frequencies. However, its disadvantages include the loss of control over the range of objective covariation levels and inability to assess the effect of expectations on covariation judgments independently of their effect on joint frequency estimates. In the second experiment, auditors stated their expectations and made covariation judgments for 11 joint frequency distributions generated by the

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[2] Relatively few studies in this area have used tasks that involve nonbinary variables [Crocker, 1981]. Also, this area is distinguished from the lens model research by its emphasis on judging covariation *per se* as opposed to an emphasis on the use of covariation information when judging a distal variable's value.

TABLE 1

2×2 JOINT FREQUENCY TABLE AND FORMAL COVARIATION MEASURES

	Presence of Y	*Absence of Y*
Presence of X	a	b
Absence of X	c	d

$n=a+b+c+d$

N_1 (difference-in-diagonals) $=[a+d]-[b+c]$

N_2 (delta coefficient) $=[a/(a+b)]-[c/(c+d)]$

N_3 (contingency coefficient) $=[\chi^2/(n+\chi^2)]^{1/2}$

N_4 (lambda coefficient) $=[max(a,c)+max(b,d)-max(a+b,c+d)]/[n-max(a+b,c+d)]$

N_5 (phi coefficient) $=[ad-bc]/[(a+c)(b+d)(a+b)(c+d)]^{1/2}$

experimenters such that the objective covariation level varied over a wide range. Although this method imposed artificiality on the heeded data, it permitted refined tests regarding auditors' data-integration rules and the effects of expectations.

The rest of the paper is organized as follows. The second section reviews the psychological literature on covariation judgments and states five hypotheses regarding auditors' covariation judgments. The third and fourth sections report the experiments. The last section provides some concluding remarks.

LITERATURE AND HYPOTHESES

The psychological research examines human performance in tasks such as the following. For a set of bivariate data $[(X,Y)$, $(X, \text{not}-Y)$, $(\text{not}-X,Y)$, $(\text{not}-X, \text{not}-Y)]$, a subject is asked to make a judgment, J, about the degree to which the variables X and Y covary.[3] The normative or objective covariation, N, may be measured by organizing the relevant data in a 2×2 joint frequency table, or its equivalent, and applying a correct data-integration rule (Table 1).[4] Accuracy may be measured by the correlation or difference between J and N, assuming comparability in scales. As noted earlier, evidence in the psychological literature indicates a tendency toward inaccuracy, although there are some conflicting results.

This literature is reviewed below with three purposes in mind: to provide an understanding of the causes of inaccuracy, to discuss experimental design issues, and to establish a basis for the hypotheses tested in this study's experiments. The review is organized in terms of three main factors that affect human covariation judgments: heeded data, rules for integrating the data, and expectations. Implications for auditing are noted where appropriate, and hypotheses regarding auditors' data-integration rules and effects of expectations are stated. Although the hypotheses do not address the issue of heeded data, its discussion is important for completeness and explaining the choice of the experimental design. The effects of auditing experience are addressed in a separate section.

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[3] The abstract variables X and Y are used for expositional purposes. In the psychological experiments, task variables typically have empirical referents, e.g., presence/absence of cloud seeding and presence/absence of rain [Ward and Jenkins, 1965].

[4] There is no consensus among mathematical statisticians regarding the normative status of various formal covariation measures [Reynolds, 1977; Somers, 1978]. To avoid the possibility that this study's findings are unduly affected by the use of a single norm, various N measures are used.

Heeded Data

Establishing the relevant data set for a covariation judgment involves various tasks that are subject to error. In deciding which types of data are relevant, subjects often fail to appreciate that all four cell frequencies in a 2×2 table are required [Nisbett and Ross, 1980]. Errors in estimating cell frequencies sometimes occur because factors unrelated to frequency (e.g., semantic or similarity relations between X and Y) influence the availability of data retrieved from memory or produced by imagination [Chapman, 1967; Tversky and Kahneman, 1973; Shweder, 1977]. When individuals hold strong (and erroneous) expectations about the covariation of interest, they tend to overestimate the number of positive, confirmatory data (cell a) and underestimate the number of disconfirmatory data (cells b and c) [Chapman and Chapman, 1967 and 1969]. Another source of error for tasks involving variables such as X and Y is the need to consider *non*occurrences as well as occurrences of events [Einhorn and Hogarth, 1978]. A consistent result in studies manipulating task difficulty is that covariation judgment accuracy decreases as establishing a data set becomes more difficult (e.g., sequential vs. simultaneous presentation of data) [Ward and Jenkins, 1965; Shaklee and Mims, 1982; Arkes and Harkness, 1983]. In auditing contexts, because joint frequency records for task variables are rarely kept, establishing an appropriate data set may be a major source of error in auditors' covariation judgments [Waller and Felix, 1984a].

Studies in which sequential (unorganized) data are displayed and subjects are asked to provide J responses but not cell frequency estimates confound the effects of data errors and errors due to incorrect integration rules. The confounding problem may be avoided by focusing on either accuracy in estimating joint frequencies or accuracy in integrating summarized data, but not both. This study focused on the latter issue—the correspondence between auditors' J responses and N for summarized data.[5]

Data-Integration Rules

It was expected that auditors would be more skilled at analyzing and inferring relations from data than most subjects in psychological experiments and that this difference would transfer to the covariation judgment task. However, establishing a baseline for evaluating auditors' relative performance was made problematic by the somewhat inconsistent results on accuracy reported in the psychological literature, even among studies that controlled for possible data errors. For a given set of cell frequencies, many data-integration rules could be applied, and the modal rule attributed to subjects has tended to vary across studies: delta [Ward and Jenkins, 1965], difference-in-diagonals [Inhelder and Piaget, 1958; Shaklee and Tucker, 1980; Shaklee and Mims, 1981; Beyth-Marom, 1982], $a-b$

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[5] To examine the issue of possible data errors would require researchers to develop the appropriate objective data bases with which auditors' joint frequency estimates could be compared.

[Shaklee and Hall, 1983]; and *a* only [Smedslund, 1963; Arkes and Harkness, 1983]. As explained below, these inconsistent results are partly due to the different techniques used to infer subjects' data-integration rules.

A straightforward technique uses subjects' self-reports about their data-integration rules [Smedslund, 1963; Beyth-Marom, 1982; Shaklee and Hall, 1983]. Because this technique relies on introspection *and* retrospective probing, its usefulness for inferences about cognitive processes is limited [Nisbett and Wilson, 1977; Ericsson and Simon, 1980]. A second technique asks subjects to make decisions based on data sets that imply certain N values for the covariation between the decision and outcome variables, and the experimenter infers subjects' data-integration rules from observed decisions [Seggie and Endersby, 1972]. This technique also is limited because subjects' decisions may be affected by their utilities for the outcomes. A third technique is to specify *ex ante* data-integration rules that are likely candidates and design a series of data sets such that a subject's pattern of responses for the series indicates the use of one and only one candidate rule [Shaklee and Tucker, 1980; Shaklee and Mims, 1981, 1982; Shaklee and Hall, 1983]. This technique is an improvement over the techniques noted above, but its validity is limited by the *ex ante* specification of the candidate rules. Also, this technique is inappropriate when the subjects generate the data sets, as in the first experiment reported below. A fourth technique is to correlate, over a number of data sets, J with various correct and incorrect integration rules and identify the rule with which J is most highly correlated [Jenkins and Ward, 1965; Ward and Jenkins, 1965; Allan and Jenkins, 1980, 1983].

The fourth technique was used in the experiments reported below. The expectation that auditors perform relatively well at the covariation judgment task would be supported by higher correlations between auditors' J responses and correct rules (Table 1) in comparison with correlations between J and incorrect rules (see below). This expectation is represented by H1.

> H1: Auditors' covariation judgments are more highly correlated with correct data-integration rules than with incorrect data-integration rules.

Expectations

Covariation judgments may be affected by prior expectations in at least two ways. First, expectations may bias the heeded data set, as noted earlier. Second, for a given data set, J may reflect both expectations and the implications of the data. In their literature review, Alloy and Tabachnik [1984] interpreted the results of many studies as being consistent with the hypothesis that the effects of expectations vs. data depend on the relative strength of each factor, although no study involving binary task variables had directly addressed their hypothesis.[6] In a study involving non-binary task variables, Wright and Murphy [1984] reported significant effects on J due to both expectations and the implications of the data (i.e., the value of N).

Whether prior expectations should affect J depends on the specific nature of the task. One important task characteristic is whether the subject or experimenter generates the data. For subject-generated data, internal consistency requires that expectations affect J if and only if they affect the data and N. An implication is that changes in context and expectations should not affect the correspondence between J and N. In the first experiment reported below, each subject generated cell frequency estimates and J responses in four contexts that were varied to induce changes in expectations. In this case, since changes in expectations should not affect the correspondence between J and N, empirical support for H2 would indicate covariation judgment inaccuracy due to an inappropriate effect of expectations.

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[6] According to Alloy and Tabachnik [1984], expectations are strong when a subject's prior knowledge of, or experience with, the pertinent relationship is extensive. Data are strong when unambiguous and sufficient to support a covariation judgment.

H2: Changes in context affect the difference between auditors' covariation judgments and the objective covariation level.

For experimenter-generated data, if a subject interprets the data as a sample and adopts a Bayesian approach, J should be affected by expectations and the implications of the data (e.g., a sample statistic for N) according to the relative strength of each factor.[7] In the second experiment reported below, the subjects stated their prior expectations and expectation strength for the covariation of interest and produced J responses for a series of experimenter-generated data sets. This permitted testing two predictions: prior expectations affect J (H3) and reliance on expectations is positively associated with expectation strength (H4).

H3: Auditors' prior expectations affect their covariation judgments.

H4: When making covariation judgments, auditors' reliance on prior expectations is positively associated with expectation strength.

Auditing Experience

The assertion that auditors are likely to outperform most subjects in psychological experiments on covariation judgment tasks does not imply a positive, linear association between accuracy and the *amount* of auditing experience. For example, auditors' superior data-analytic skills may be attributable to early career training or self-selection rather than the accumulation of auditing experience. Accuracy may actually decrease as the lapse of time since formal training increases. We consider this to be an open issue and state H5 merely as a frame for the data analysis.

H5: Covariation judgment accuracy increases with the amount of auditing experience.

The first experiment reported below provided evidence on H1, H2, and H5. The second provided evidence on H3 and H4, as well as additional evidence on H1 and H5.

EXPERIMENT 1

Method

Subjects. The subjects were 61 auditors from a Big Eight public accounting firm, having a mean of 47 months of auditing experience and having worked on a mean of 32 audits. All but one subject had taken one or more statistics courses in college. All subjects were in attendance at various training seminars at the firm's national location for professional development.

Procedure and Task. Each subject provided responses to a seven-part questionnaire. Part 1 presented general instructions. Part 2 presented a (nonauditing) practice exercise using the same format and response scales as those in four auditing problems presented in Parts 3 through 6. Part 7 asked questions regarding auditing experience and background in statistics.

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[7] Alternatively, a subject may interpret the data as a population, in which case expectations should not affect a J response with respect to that population.

For a given auditing problem, each subject considered a group of 100 clients which (1) had one of four pairs of characteristics regarding financial quality and size/diversification (see below) and (2) were similar to actual clients with whom he or she had worked or become very familiar through discussions with associates.[8] Each subject made four joint frequency estimates—out of the 100 clients, the number experiencing the co-occurrence of an increase/decrease in pre-audit net income excluding bad debt expense from one fiscal year to the next and increase/decrease in the pre-audit allowance for doubtful accounts over the same period of time.

Each subject then judged the covariation between the direction of the change in income and direction of the change in the allowance of the account, for the specified group of 100 clients. Covariation was described as the degree to which "your knowing whether the pre-audit NET INCOME figure excluding BAD DEBTS EXPENSE increased or decreased from one fiscal year to the next fiscal year will help you to predict whether the pre-audit balance of the ALLOWANCE FOR DOUBTFUL ACCOUNTS increased or decreased over the same period of time." Each subject marked a J response on a 101-point scale with the following anchors: "Knowing that information does not help me to predict at all" (0) and "Knowing that information allows me to predict perfectly" (100). This scale is based on the one described by Shweder [1977] and is consistent with the logic underlying the proportional-reduction-in-error measures of formal covariation [Reynolds, 1977].

Context Variables. Two within-subject context variables were manipulated over the four auditing problems: (1) financial quality, i.e., the problem dealt with clients maintaining the status quo with respect to financial position in the year preceding the audit or clients experiencing serious financial difficulties in the year preceding the audit; and (2) size/diversification, i.e., the problem dealt with clients that were small, local companies selling only a single product to a few major credit customers in the year preceding the audit or clients that were large, highly diversified companies selling a variety of products to many types and sizes of credit customers in the year preceding the audit. These context variables were intended to induce changes in the subjects' expectations about the covariation of interest described above. The order of the four problems was randomized over subjects.

Results

Data-Integration Rules. H1 predicted that auditors' covariation judgments are more highly correlated with correct data-integration rules than with incorrect rules. Over subjects and problems ($n=244$), Pearson correlation coefficients were computed for J and various correct and incorrect rules applied to the subjects' joint frequency estimates.[9]

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[8] The subjects were asked to consider a hypothetical group of 100 clients rather than draw directly from their experience to avoid problems in comparing the responses of subjects who differed greatly in terms of the number of audits on which they had worked.

[9] The analysis was done on an aggregate basis because each subject did not provide a sufficient number of judgments for a within-subject analysis (see Experiment 2). Analyses performed for each problem taken separately yielded results that were very similar to those of the aggregate analysis.

TABLE 2

PEARSON CORRELATION COEFFICIENTS BETWEEN AUDITORS' *J* RESPONSES AND VARIOUS DATA-INTEGRATION RULES (EXPERIMENT 1)

Incorrect Data-Integration Rules:	*r*
a	0.01
b	0.00
c	0.05
d	−0.13*
$a+b$	0.01
$a-b$	0.01
$a+c$	0.06
$a-c$	−0.02
$a+d$	−0.08
$a-d$	0.07
$a/(a+b)$	−0.02
$a/(a+c)$	−0.06
$a/(a+d)$	0.03
$b/(b+d)$	0.02
$c/(c+d)$	0.11*
Correct Data-Integration Rules (see Table 1):	
N_1	0.38**
N_2	0.26**
N_3	0.24**
N_4	0.30**
N_5	0.25**

* Significant at 0.05.
** Significant at 0.01.

Absolute values were used for objective covariation measures with $[-1,1]$ scales, which is consistent with the *J* response scale used in the experiment.

J was significantly correlated with all of the correct rules but insignificantly correlated with most of the incorrect rules (Table 2). Further, *t*-tests for nonindependent samples generally indicated that the correlations between *J* and correct rules were significantly higher than correlations between *J* and incorrect rules (Table 3). For example, the entry of 4.66 in the upper left-hand corner of Table 3 indicates that $r=0.38$ for *J* and N_1 is significantly ($p<0.01$) higher than $r=0.01$ for *J* and *a*. These results are consistent with H1.

Context and Expectations. H2 concerned the effect of changes in context on the difference between auditors' *J* responses and *N* based on their joint frequency estimates. A repeated-measures analysis of variance was performed using a measure of inaccuracy ($J-N_5'$, where N_5' equals 100 times the absolute value of the phi coefficient based on the subjects' joint frequency estimates) as the dependent variable, with financial quality and size/diversification as within-subject factors. Inaccuracy was affected by financial quality (mean for clients with finan-

TABLE 3

t-VALUES FROM TESTS OF DIFFERENCES BETWEEN r FOR J AND CORRECT RULES
VS. r FOR J AND INCORRECT RULES
(EXPERIMENT 1)

	Correct Data-Integration Rules (see Table 1)				
Incorrect Data-Integration Rules	N_1	N_2	N_3	N_4	N_5
a	4.66	2.79	2.90	3.42	2.97
b	4.21	3.11	2.95	3.94	3.15
c	4.35	2.40	1.93**	2.67	2.08**
d	3.43	1.52*	1.30*	2.05**	1.43*
$a+b$	4.39	2.88	3.05	3.71	3.17
$a-b$	4.80	2.73	2.68	3.20	2.75
$a+c$	4.54	2.14**	1.86**	2.51	2.07**
$a-c$	4.28	2.77	2.65	3.44	2.94
$a+d$	3.66	2.08**	2.09**	2.70	2.17**
$a-d$	4.11	2.15**	2.11**	2.74	2.23**
$a/(a+b)$	4.47	2.74	2.57	3.36	2.71
$a/(a+c)$	3.94	2.32**	1.78**	2.85	1.90**
$a/(a+d)$	4.33	2.38	2.68	3.09	2.66
$b/(b+d)$	4.10	2.75	2.73	3.52	2.88
$c/(c+d)$	3.58	1.60*	1.40*	2.13**	1.53*

Note: t-values significant at 0.10 (0.05) are designated by * (**). All other t-values are significant at 0.01.

cial difficulties = 19.8, mean for clients without financial difficulties = 28.3), but not by size/diversification (mean for small clients = 24.9, mean for large clients = 23.2) or the interaction (Panel A of Table 4).[10]

The overall means were 45.8 for J and 21.8 for N_5'. J was not affected by financial quality (mean for clients with financial difficulties = 45.2, mean for clients without financial difficulties = 46.5), size/diversification (mean for small clients = 46.2, mean for large clients = 45.5), or the interaction (Panel B of Table 4). However, N_5' was affected by financial quality (mean for clients with financial difficulties = 25.4, mean for clients without financial difficulties = 18.2), though not by size/diversification (mean for small clients = 21.3, mean for large clients = 22.3) or the interaction (Panel C of Table 4). The results for the financial quality variable indicate an inconsistency, since changes in the subjects' joint frequency estimates implied higher objective covariation levels for clients with vs. clients without financial difficulties, but there were not similar changes in their covariation judgments.

Amount of Auditing Experience. H5 concerned the association between covariation judgment accuracy and the amount of auditing experience. Inaccuracy again was measured by $J-N_5'$. Amount of auditing experience was measured by standardizing the number of audits worked on and months of auditing experience and summing the two z-scores for each subject.[11] The correlation between inaccuracy and amount of audit-

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[10] When the analysis was repeated with other measures of inaccuracy, the results were very similar.

[11] Audits worked on and months of auditing experience were highly correlated ($r=0.88$, $p<0.01$).

TABLE 4
ANALYSES OF VARIANCE
(EXPERIMENT 1)

	Sum of Squares	*df*	*F*	*p*
Panel A (Dependent variable is $J-N'_5$):				
Main Effects:				
Financial Quality	3,896	1	8.58	0.01
Size/Diversification	93	1	0.23	0.63
Interaction:				
Financial Quality by Size/Diversification	70	1	0.19	0.66
Total	22,344	61		
Panel B (Dependent variable is J):				
Main Effects:				
Financial Quality	98	1	0.50	0.48
Size/Diversification	30	1	0.10	0.75
Interaction:				
Financial Quality by Size/Diversification	45	1	0.30	0.59
Total	17,081	61		
Panel C (Dependent variable is N'_5):				
Main Effects:				
Financial Quality	2,756	1	10.43	0.01
Size/Diversification	18	1	0.08	0.78
Interaction:				
Financial Quality by Size/Diversification	3	1	0.01	0.92
Total	13,870	61		

ing experience was $r=0.20$ ($p<0.01$).[12] Further analyses indicated that the correlation between J and amount of auditing experience was low but positive ($r=0.15$, $p<0.01$), while the correlation between amount of auditing experience and N'_5 was low but negative ($r=-0.14$, $p<0.02$). That is, even though the data generated by the more experienced subjects generally indicated lower objective covariation levels, they still made higher covariation judgments.

Other Results. Additional t-tests showed that (both signed and absolute) differences between J and various measures of N transformed to a [0, 100] scale were significantly greater than zero (Table 5). These results indicate a tendency to overstate the objective covariation level.

Summary and Discussion. Experiment 1 provided evidence regarding the nature of auditors' data-integration rules when judging covariation, as well as evidence regarding effects of context and amount of auditing experience on covariation

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[12] When the analysis was repeated with other measures of inaccuracy, the results were very similar.

TABLE 5
DIFFERENCES BETWEEN J AND OBJECTIVE COVARIATION LEVELS
(EXPERIMENT 1)

Inaccuracy	*Signed* (*Mean*)	t	*Absolute* (*Mean*)	t
$J-N_2$	18.8	9.1	29.2	19.8
$J-N_3$	37.1	21.7	37.9	23.2
$J-N_4$	26.3	14.3	30.5	19.7
$J-N_5$	24.1	12.4	30.0	19.2

Note: All t-values are significant at 0.01.

judgment accuracy. In the aggregate, the subjects' covariation judgments were more highly correlated with correct rules than with incorrect rules, and most highly correlated with the difference-in-diagonals rule (cf. Inhelder and Piaget [1958], Shaklee and Tucker [1980], Shaklee and Mims [1981], and Beyth-Marom [1982]). Thus, using the correlation between J and N as an evaluation criterion, the subjects' covariation judgments were to a significant degree paramorphic to formal covariation models.

However, the following qualifications should be noted. First, for clients with vs. clients without financial difficulties, changes in the subjects' joint frequency estimates implied higher objective covariation levels, yet their covariation judgments remained about the same. One explanation involves the within-subject manipulation of context. Subjects may have erroneously thought that internal consistency demanded *no* change in their covariation judgments over contexts. This explanation, however, would seem to require constancy in the subjects' frequency estimates as well as covariation judgments. A more plausible explanation is that the subjects' expectations affected their joint frequency estimates and covariation judgments in different ways. An auditor's knowledge about audit events and variables may be structured in a manner that fails to ensure the internal consistency required by a formal covariation model [Waller and Felix, 1984a].

Second, covariation judgment accuracy decreased with the amount of auditing experience. The more experienced subjects judged somewhat higher covariations even though their joint frequency estimates implied somewhat lower covariations. The lapse of time since formal instruction in statistics may have contributed to this result. Another possibility, consistent with the above discussion, is that the differential effects of expectations on joint frequency estimates vs. covariation judgments are amplified by auditing experience.

Third, the results showed a tendency to overstate the objective covariation level. This suggests that auditors may overstate the inferential value of some task variables, with the possible consequence of inappropriately collecting and relying on information about the values of such variables. However, the objective covariation levels generally were low and the subjects' responses may have been influenced by a tendency to avoid extreme responses.

Experiment 1 has four limitations which were addressed in Experiment 2. First, because the subjects generated the joint frequencies, it was not possible to control the objective covariation levels. The result was a limited range of rather low objective covariation levels, which probably contributed to the tendency to overstate the objective covariation level. Second, having the subjects generate the joint frequencies precluded a test of the effect of expectations on covariation judgments independent of their effect on joint frequency estimates. Third, inferences about the subjects' data-integration rules were limited by the procedure of computing correlations between covariation judgments and rules over many subjects. Experiment 2 countered these three limitations by having each subject make covariation judgments for 11 data sets generated by the experimenters such that the objective covariation level varied over a wide range. At the cost of imposing artificiality on the heeded data, this method permitted inferences about data-integration rules at the individual subject level as well as producing more complete evidence on tendencies toward overstatement or understatement and the effect of expectations. Fourth, Experiment 1 did not measure the subjects' expectations or expectation strength. This precluded direct tests of the effects of auditors' expectations and expectation strength on their covariation judgments. In Experiment 2, the subjects' prior expectations and expectation strength were measured.

EXPERIMENT 2

Method

Subjects. The subjects were 45 auditors from three Big Eight public accounting firms, having a mean of 66 months of auditing experience and having worked on a mean of 47 audits. All but one subject had taken one or more statistics courses in college.

Procedure and Task. Each subject provided responses to a four-part questionnaire. Part 1 presented general instructions. Part 2 presented a (nonauditing) practice exercise using the same format and response scales as those in an auditing problem presented in Part 3. Part 4 asked questions regarding auditing experience and background in statistics.

The subjects were presented with either of two auditing problems (see below), which required the following responses. Each subject indicated his or her prior expectations about the covariation between two task variables, based solely on prior knowledge gained from education or experience. The definitions of covariation and J response scale were the same as those used in Experiment 1. Each subject then indicated the adequacy of his or her prior knowledge base using a 101-point scale with the following anchors: "My knowledge base is completely *inadequate* for judging this covariation" (0) and "My knowledge base is completely *adequate* for judging this covariation" (100). This response provided a measure of expectation strength. Next, each subject was presented with 11 sets of bivariate data pertaining to the task variables (Table 6) and was asked to provide a J response for each data set.[13] Two random orders of the data sets were used. The subjects were asked to consider each data set independently.[14]

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[13] The data sets were specified subject to two constraints. First, over the 11 data sets, phi ranged from 0.00 to 1.00 in increments of 0.10. Second, the correlation between phi and each cell frequency was minimized to reduce the possibility of a spurious correlation between phi and J responses of subjects using incorrect rules such as the cell a rule.

[14] The subjects' J responses for the data sets may have been affected by the procedure whereby prior expecta-

TABLE 6
DATA SETS PRESENTED TO SUBJECTS
(EXPERIMENT 2)

N_s	Cell a	Cell b	Cell c	Cell d
0.0	19	10	19	10
0.1	6	11	9	26
0.2	8	2	8	5
0.3	59	17	70	82
0.4	86	22	77	128
0.5	40	11	17	43
0.6	18	4	7	27
0.7	34	10	7	76
0.8	72	14	4	85
0.9	109	3	8	99
1.0	5	0	0	22

Context Variable. A between-subjects manipulation of context involved the task variables for which covariation was judged. Twenty-two subjects judged the covariation between the presence/absence of a downturn in the economy and presence/absence of a material audit adjustment to income for clients with highly competent accounting personnel. Twenty-three subjects judged the covariation between the presence/absence of a material audit adjustment to inventory in year $y-1$ and presence/absence of a material audit adjustment to the same account in year y. This manipulation was included to create variance in the subjects' expectations for the covariation of interest.

Results

Data-Integration Rules. To provide additional evidence regarding H1, for each subject over the 11 data sets, Pearson correlation coefficients were computed for J with N'_s and with various incorrect data-integration rules. Phi was used as the only correct data-integration rule because of the very high correlations between various formal covariation measures for the 11 data sets (e.g., the correlation between phi and delta was 0.9995). Each subject was categorized as using the rule with which J was most highly correlated (Table 7). There were 24 subjects categorized as using N'_s, for whom the median correlation between J and N'_s was $r=0.93$. Although some subjects were categorized as using incorrect rules, the overall results are consistent with H1.

Expectations. H3 predicted that auditors' prior expectations affect their covariation judgments. Because the between-subjects context variable had an insignificant effect on prior expectations and J responses, data for the two groups were analyzed together.[15] For each sub-

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tions were elicited first. Two design alternatives were considered and rejected. Having some subjects not state prior expectations would have permitted a test for an effect due to stating expectations, but this would have reduced the power of the tests of H3 and H4. Having some subjects state expectations *after* making J responses for the data sets was rejected because of the contaminating effect that task performance might have had on retrospective "prior" expectations.

[15] Prior expectations did not differ significantly over the two problems ($t=0.29, p>0.10$; mean for the prob-

Table 7
Inferred Data-Integration Rules
(Experiment 2)

Rule	*Number of Subjects Whose J Responses Correlated Most Highly with Rule*	*Median r*
a	0	—
b	2	0.71
c	0	—
d	0	—
$a+b$	1	0.62
$a-b$	1	0.83
$a+c$	1	0.85
$a-c$	2	0.81
$a+d$	2	0.94
$a-d$	0	—
$a/(a+b)$	2	0.85
$a/(a+c)$	1	0.80
$a/(a+d)$	2	0.73
$b/(b+d)$	1	0.80
$c/(c+d)$	6	0.87
N_5	24	0.93
	45	

ject, the following probability was computed: $P(\tilde{q}>q|n,\ p=0.50)$, where n equals the number of data sets for which a bias due to expectations was possible (i.e., data sets for which neither a subject's expectations nor J response equaled N'_5) and q equals the number of data sets for which J deviated from N'_5 in the direction of expectations. A high value of q/n would indicate a bias toward expectations. Although q/n exceeded 0.50 for 29 of the 45 subjects, $P(.|.)$ was less than 0.05 for only 15 subjects, indicating that the overall effect of expectations was weak.

Expectation Strength. H4 predicted that auditors' reliance on prior expectations is positively associated with expectation strength. For each subject, the mean absolute difference between expectations and J was computed. Reliance on expectations is presumed to increase as this difference decreases. Over subjects, the correlation between this difference and expectation strength was $r=-0.33$ ($p<0.01$), indicating that the extent to which the subjects relied on expectations depended on the strength of expectations.[16] This result is consistent with H4.

Amount of Auditing Experience. To provide additional evidence regarding H5, the association between inaccuracy and the amount of auditing experience was examined. Inaccuracy was measured

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lem involving economic downturns and audit adjustments = 36.4, mean for the problem involving audit adjustments in two consecutive years = 38.6). J responses for the two problems were compared over the 11 data sets using a Hotelling T^2 test. The mean (sd) for the problem involving economic downturns and audit adjustments was 52.8 (16.8) and the mean (sd) for the problem involving audit adjustments in two consecutive years was 58.8 (16.6). This difference was not significant ($T^2=7.27, p>0.10$).

[16] Expectation strength had a mean (sd) of 48.8 (22.4).

TABLE 8

DIFFERENCES BETWEEN J AND N_5'

(EXPERIMENT 2)

N_5'	*Signed* (*Mean*)	t	*Absolute* (*Mean*)	t
0	30.0	7.48**	30.0	7.48**
10	29.6	8.36**	30.6	9.20**
20	14.8	3.84**	23.5	8.75**
30	12.3	4.17**	19.2	9.92**
40	11.6	3.72**	20.5	11.56**
50	7.2	2.38*	19.9	18.27**
60	1.7	0.53	18.5	10.74**
70	−5.0	−1.61	16.4	8.01**
80	−8.0	−2.79**	13.6	5.86**
90	−9.0	−3.12**	12.6	4.89**
100	−20.4	−4.77**	20.4	4.77**

* Significant at 0.05.
** Significant at 0.01.

for each subject by the mean difference between J and N_5'. The amount of auditing experience was measured as in Experiment 1.[17] The correlation between inaccuracy and amount of auditing experience was $r=0.11, p>0.10$. Similar results were obtained when each problem and data set was examined separately, except in the case of $N_5'=20$ where the correlation between inaccuracy and experience was $r=0.25$, $p<0.05$. These results generally indicate a negligible association between inaccuracy and amount of auditing experience.

Other Results. For each data set, J was compared with N_5' to test for overstatements/understatements. There was a tendency to overstate (understate) low (high) values of N_5', and absolute differences were significantly greater than zero at all levels of N_5' (Table 8).

Summary and Discussion. Experiment 2 provided evidence regarding the effects of expectations and expectation strength on auditors' covariation judgments, as well as additional evidence regarding the nature of their data-integration rules and effects of auditing experience on accuracy. Based on correlations between the subjects' covariation judgments and various data-integration rules, 53 percent of the subjects were categorized as using a correct rule, 13 percent as using a rule based on $c/(c+d)$, and the remainder as using other incorrect rules. Also, based on the percentage of variance in their covariation judgments explained by the inferred integration rules, the subjects apparently relied heavily on the available data. Taken together, the results of Experiments 1 and 2 support the conclusion that, despite some individual differences, auditors tend to use data-integration rules that are sensitive to the objective covariation level in the available data.

As in Experiment 1, there was a tendency to overstate low objective covariation levels. Further, there was a tendency to understate high objective covariation levels, while for moderate objective covariation levels, different subjects' overstatements and understatements largely offset each other.

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[17] Audits worked on and months of auditing experience were highly correlated ($r=0.93, p<0.01$).

Factors other than the rule-based implications of available data had little influence on the subjects' covariation judgments. Only a minority of subjects were significantly influenced by their expectations. This is contrary to Nisbett and Ross' [1980, p. 10] conjecture that "expectations may be more important to the perception of covariation than are the actually observed data configurations." Reliance on expectations, while generally small, was positively related to expectation strength (cf. Alloy and Tabachnik [1984]). Finally, the effect of auditing experience on accuracy was negligible. The results of both experiments support the conclusion that, although auditors apparently are able to judge covariation for observed data with considerable accuracy (at least in terms of correlation with correct rules), this ability is not due to the accumulation of auditing experience. The ability may be due to early career training and/or self-selection.

CONCLUDING REMARKS

These experiments suggest that auditors rely on available bivariate data when judging covariations between task variables and use data-integration rules that are sensitive to the objective covariation level. Of course, the technique used to infer the subjects' rules produced only approximate descriptions, and future research might employ alternative techniques to refine these descriptions. In addition, pursuit of the following research issues might be profitable.

First, overstatements and/or understatements of the objective covariation level were repeatedly observed in both experiments. Overstatements/understatements may have efficiency and effectiveness implications for auditors in their identification of variables that are useful for inference making. Future research might use alternative response scales to determine whether these apparent errors represent misperceptions or merely response biases. Second, in light of the internal inconsistency observed in Experiment 1, future research might examine the cognitive processes by which expectations are mapped into joint frequency estimates vs. covariation judgments. Third, consistent with most psychological studies, this study focused on auditors' covariation judgments for binary variables. Future research might use task variables with interval or ratio scales, which are typically encountered in judgmental analytical review. Finally, this study abstracted from possible errors in auditors' covariation judgments due to faulty data. Future research should examine the factors that potentially cause errors in auditors' frequency and joint frequency estimates (cf. Libby [1985]). In real-world settings, auditors' covariation judgments based on observed or experiential data may be complicated by factors such as event categories that change over time or have "fuzzy" boundaries, gaps in time and space between the components of each bivariate datum, and availability biases for data that are vivid, recent, and/or economically significant. These complications may produce serious inaccuracies in auditors' covariation judgments despite their use of correct data-integration rules.

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The Incremental Information Content of the Accrual and Funds Components of Earnings After Controlling for Earnings

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ABSTRACT: This study investigates whether the accrual and funds components of earnings have incremental information content beyond earnings itself. The research design is motivated by the insight that earnings and revenues are announced in the *Wall Street Journal* before the annual report, which contains both accrual and funds items, is released. This allows a direct measurement of the incremental information content of the accrual and funds components of earnings which is not possible when these releases are treated contemporaneously. This study finds evidence of an association between stock returns, measured over a short interval covering the date the annual reports arrive at the SEC, and new information about the cash and noncash components of earnings released at that time. By itself, this result implies that at least one of these components has information content. After controlling for earnings, incremental information about the cash and noncash components of earnings is precisely the same.

THIS paper investigates the incremental information content[1] of the accrual and funds components of earnings beyond earnings itself. Several authors have considered this and similar issues using a variety of funds definitions and methodologies. Ball and Brown [1968] and Beaver and Dukes [1972] each compared the dependence of stock returns on earnings and cash flows defined as earnings plus depreciation and amortization. Although both studies found a larger dependence on earnings, their results were not statistically significant. Kaplan and Patell [1977] tried to measure the incremental effect of working capital from operations after con-

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trolling for an earnings effect. However, because of the high correlation between earnings and working capital from operations, they could not separate this incremental effect. Other papers that have investigated issues related to the information content of earnings and cash flow measures include Beaver, Griffin, and Landsman [1982]; Easton [1983]; Rayburn [1986]; and Bowen, Burgstahler, and Daley [1986b].

As in Kaplan and Patell, the hypothesis considered in this study is that, conditional on knowing earnings, investors do not change their assessment of share value when they observe funds from operations. The tests performed here are motivated by the insight that earnings and revenues are announced in the *Wall Street Journal* before the annual report, which contains both accruals and funds, is released. This allows a direct measurement of the incremental information content of the accrual and cash components of earnings which is not possible when these releases are treated contemporaneously.

This paper considers two ways to decompose earnings. Each alternative splits earnings into two parts: a funds from operations component and a corresponding accrual component. In one case, the funds component is working capital from operations, and the accrual component is the *noncurrent accruals* variable, which is defined here as working capital from operations less earnings.[2] In the other case, the funds component is cash from operations and the accrual component is the *total accruals* variable, which is defined here as cash from operations less earnings. The term "accruals" will be used when it is not necessary to distinguish between the noncurrent and total accruals. Similarly, "funds" and "cash flow" are used interchangeably when it is not necessary to distinguish between working capital and cash from operations.

For both decompositions, earnings is the difference between funds from operations and the corresponding accrual component. Thus, in the interval between the earnings and funds announcements, when no new information is learned about earnings, new information about the accrual and funds components of earnings is the same.[3] Accordingly, at the funds announcement date, it is impossible to determine the *individual* contributions of accruals and funds to the magnitude of the stock price reaction. In this case, information content implies that the accrual and funds components of earnings, taken together, have incre-

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[1] Strictly speaking, the expression "incremental information content" is used differently here than in other studies. Typically, C is said to have incremental information content over E if $f(R|E,C)\neq f(R|E)$, where f is a probability density function and R is a stock return measured over an interval which contains the dates when E and C are released. In this study, information about an earnings component, C, is said to have incremental information content over earnings, E, if $f(R|C)\neq f(R)$, where R is measured over an interval subsequent to the earnings announcement. Thus, there is an assumption that earnings are fully impounded in share price before the start of the interval over which R is measured. Evidence presented later supports this assumption for the sample used here. There is not a significant association between earnings and stock returns at the date the annual report arrives at the SEC.

[2] Working capital from operations is defined here as earnings after extraordinary items plus noncurrent accruals (i.e., discontinued operations + deferred taxes + depreciation and amortization + unremitted earnings of unconsolidated subsidiaries + adjustments for other noncurrent accruals used in the determination of earnings). Cash from operations is defined here as working capital from operations plus *current accruals* (i.e., the net changes in all of the working capital accounts except for changes in cash, marketable securities, and short-term debt). These definitions were adopted here because they were used most frequently in the financial statements of the sample firms. However, there is no universal acceptance of these definitions.

[3] Here the terms "new information" or "unexpected information" are used interchangeably to denote the change in expectations about a variable over an interval.

mental information content beyond earnings.

There are several reasons why this study is investigating these particular funds items: (1) They have been central to an "earnings versus cash flow" debate which has expanded from a focus on working capital from operations versus earnings to a more recent interest in cash from operations. (2) From an informational "usefulness" perspective they are associated with qualitatively different measures of a firm's financial status. Working capital from operations is more closely related to long-run profitability, whereas cash from operations is more closely related to recent operations and liquidity. (3) There seems to be a demand by investors for information about these particular funds items as evidenced by the formats of most firms' financial statements. Most firms that reconcile earnings to cash from operations include working capital from operations as the only intermediate subtotal in this reconciliation. (4) Both of these funds items are less correlated with earnings than earnings plus depreciation and are therefore more likely to have incremental information content beyond earnings.[4]

This study finds evidence of an association between stock returns, measured over a nine-day interval centered on the date the annual reports arrive at the SEC, and new information about cash from operations released during this interval. This implies that the cash from operations and total accrual components of earnings, taken together, have information content beyond earnings itself. In contrast, there is insufficient evidence to conclude that the noncurrent accrual and working capital from operations components of earnings have incremental information content beyond earnings.

A related paper by the author [Wilson, 1986] uses returns at both the earnings and funds announcement dates to address the question of whether the accrual component of earnings has incremental information content beyond the funds component. It presents a model which structures the way information about the components is extracted from earnings when earnings are announced. It also links the association between this component information and stock returns at the earnings announcement to the association between stock returns and the common component information released on the date the annual report arrives at the SEC. Although that model also addresses the question studied in this paper, the approach here has five distinct features. First, using a familiar approach, evidence is provided that the annual report release *is* an informational event.[5] The model in the extension is considerably more complex and is estimated using information from both the earnings and funds data simultaneously. Thus, it is not possible to separate the incremental effects of the individual announcements. In particular, in the absence of the results presented here, it could be argued that the findings in the related paper are primarily due to information released at the earnings announcement. Second, other studies concerned with the information content of *any* annual report item can use the approach presented here to control for information released at the earnings announcement. In contrast, the extension model is only applicable to situations where the item of interest is a component of earnings. Third, this study considers the cross-sectional differences in the ways firms release and investors secure financial statement information. This includes an investigation of the items contained in the annual earnings news releases, a discussion of the various ways analysts purchase documents containing financial statements once they are submitted to the SEC, and the results from a questionnaire which asked analysts how they secure information and the extent to which they use it to assess share value. Collectively, these discussions describe institutional features that will be useful in related studies and emphasize the need for additional research to improve the procedure used here to measure the information content of non-earnings items contained in the annual report. Fourth, hold-out tests and resampling procedures are used to compare alternative forecasting models and to assess whether the asymptotic procedures used here are sensitive to the finite sample size limitation. Finally, this paper contains a discussion concerning the tradeoffs between power considerations and scope of inquiry which is applicable in any study which uses the Hotelling T^2 for hypotheses testing.

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[4] Bowen, Burgstahler, and Daley [1986a] report mean correlation coefficients between annual earnings and annual earnings plus depreciation of 0.940, annual earnings and annual working capital from operations of 0.754, and annual earnings and annual cash from operations of 0.223. Quarterly measures are used here but the results are comparable. Although the correlation between earnings and earnings plus depreciation was not determined, the correlations between earnings and working capital from operations (0.777) and earnings and cash from operations (0.124) support the Bowen, Burgstahler, and Daley findings.

[5] Foster and Vickrey [1978] also provide evidence that the release of financial statements is an information event. For fiscal 1973 they use a cross-sectional paired difference test ($z=1.45$, $p=0.074$) to demonstrate that the 10-K has incremental information content beyond the annual report. This study can be viewed as an extension of their earlier work, in that it investigates the information content of specific financial statement items and provides detail about the cross-sectional differences in the ways this information is disseminated.

The paper proceeds as follows. The first section states the hypothesis associated with the question addressed here and establishes the motivation for the study while the second establishes that investors observe earnings and funds at two distinct dates that can be covered by mutually exclusive event intervals. The third section develops a model that addresses the question of whether the components of earnings have incremental information content beyond earnings itself. The fourth section discusses sampling and scaling procedures and controls for outliers and the fifth presents the findings. The final section summarizes these results and suggests future extensions.

HYPOTHESIS AND MOTIVATION

The question addressed here can be formulated as the following null hypothesis:

> H_0: The accrual and funds components of earnings, taken together, have *no* incremental information content beyond earnings.

To the extent investors believe earnings is a sufficient statistic relative to its accrual and funds components for assessing share value, it will be difficult to reject this null. Yet, there is some evidence that the demand for information about these components may be quite small relative to the demand for earnings information. For example, analysts' buy/sell reports frequently discuss the potential of a stock only in terms of earnings and price earnings multiples, and the results from an analyst questionnaire indicate some analysts use earnings, but not its components, to assess share value.[6] Other evidence that suggests there might be minimal interest in the accrual funds components of earnings includes: the fact that earnings are published in the *Wall Street Journal* shortly after the close of the fiscal year, but component information is generally not available until audited financial statements are released four to eight weeks later; that managers are sometimes criticized for selecting projects based on earnings rather than cash flow; that managers' explicit compensation schemes are typically based on earnings, not funds items; that there are considerably more earnings than cash flow forecasts; and that cash flow forecasts, such as those provided by Value Line, usually use an earnings-plus-depreciation definition of cash flow. Thus, *ex ante*, there are several reasons why H_0 might be difficult to reject.

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[6] The questionnaire was mailed out to 400 members of the Financial Analysts Federation (FAF) randomly selected by FAF from their 19,000 members. Although the response rate was only 15 percent, the survey provides some insight about the extent to which investors use earnings, working capital from operations, and cash from operations in assessing firm value. Sixty of the questionnaires were returned, and 40 of the respondents claimed they had used earnings to assess the value of all the firms they had followed closely over a one-year period, where-

In contrast, several members of the financial community believe H_0 does not hold. Indeed, there is considerable support among authors of finance texts, financial consultants, and members of the FASB for the view that the components of earnings affect stock price differently. However, this group is divided as to whether accruals are useful for assessing share value. On the one hand, the FASB and the SEC currently support the use of both cash flows and earnings in assessing future cash flows. (In other words, the components of earnings are viewed as having incremental value beyond earnings itself.) On the other hand, some financial analysts have questioned the reliability and relevance of earnings primarily because of their accrual components. To these individuals, the components of earnings have incremental information content beyond earnings because earnings is a noisy signal about funds from operation. For example, the following excerpt from a Chase Financial brochure advocates that investors should abandon concern for earnings-per-share and adopt a cash flow perspective.

> What financial measures do you use when making policy decisions? Earnings per share? Earnings growth rate? Price/earnings multiple? Dilution? Popular as these guidelines are, formulating plans and policies around them could easily result in the misallocation of valuable corporate resources and adversely affect shareholders' values.
>
> We can help you focus on the real issues—the underlying economics rather than accounting data . . .
>
> Empirical evidence has shown that a company's share price is determined primarily by sophisticated, well informed investors. It is their perception of risk/reward trade-offs, as well as their expectations of future cash earnings and expenditures needed to produce those earnings, that largely determine the market price of stocks. It is cash-in minus cash-out, or Free Cash Flow, that counts—not accounting earnings or their growth.

This brochure suggests that sophisticated investors do not find accruals to have incremental information beyond current cash flows for predicting future cash flows (H_0 does not hold), and that managers who gear their policies around earnings data do not understand how this information affects their share price. Moreover, it indicates that results from empirical studies might influence management's perception of how share price

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as 14 (22) indicated they had used working capital (cash) from operations for this purpose. Moreover, some analysts do not find funds information to be incrementally useful beyond earnings even though they claim to analyze funds information frequently. When asked to focus on their investment activities during the past year, 11 of the respondents claimed neither working capital nor cash from operations had incremental information beyond earnings for the majority of the firms they followed.

is set. This observation is also supported by Stern [1972].

THE FLOW OF INFORMATION

Specifying the Event Interval

The subsequent empirical tests presume it is possible to specify intervals wide enough to include the dates most investors obtain a specific type of information, yet narrow enough so they do not overlap or sacrifice power. This section presents evidence concerning the validity of this assumption and considers the relative merits of several proxies for centering event intervals. In the process of developing these arguments, the investigation presents several facts concerning the flow of information and suggests some controls in the research design.

The date earnings are published in the *Wall Street Journal* is used as a proxy for the first date investors observe earnings and revenues.[7] What makes this proxy particularly appealing is that a single information intermediary, the *Wall Street Journal*, distributes earnings in a timely fashion, for a large number of firms, to a broad audience, at the same low cost to all investors. In contrast to earnings, funds from operations are not published in the *Wall Street Journal* or in any other single medium with a broad audience. Moreover, various documents are used to release funds items, including annual reports, 10-Ks and, in some cases, earnings news releases. Release dates of these documents are candidates for proxies for the first date funds are released.

The extent to which investors have timely access to a firm's funds information depends on whether funds are first released in the annual report or in the 10-K. If funds are first released when a firm mails its annual report to shareholders, then it is reasonable to assume that many investors first see funds close to the date the annual report arrives at the SEC. This argument is based on the belief that most investors who follow a firm closely are probably on the annual report mailing list and that most firms probably mail their annual reports to shareholders and the SEC on the same date.[8] However, if the 10-K is issued before the annual report, some investors may use the 10-K while others may wait for the annual report. The results from the analyst questionnaire substantiate that some investors wait for the annual report even if the 10-K is issued earlier.[9] At first glance this statement seems to suggest that the stock market is inefficient with respect to this component information. However, if information is costly and some investors are informed while others are not, prices may not be fully revealing. Moreover, it may be perfectly rational for some investors to wait and secure their information at a lower cost. In fact, there is evidence that information intermediaries distribute financial statements sequentially to different groups of investors at rates that decline over time. Some investors with relatively large holdings pay for photocopies of documents within two days of the date they are submitted to the SEC or NYSE, while others pay less for microfiche copies that are available anywhere from two to 15 days later.[10] The length of this adjustment process may, however, be shorter if the annual report is released before the 10-K. In this case, as argued above, many investors will probably receive the annual report shortly after the firm releases it. In addition, at least for the firms sampled here, the 10-K is more likely than the annual report to arrive at the SEC during a peak period.

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[7] Regardless of whether dates on which firms release and investors observe information coincide, it will be convenient for expositional purposes to act "as if" they do.

[8] This claim is supported by anecdotal evidence. Ten firms in the sample were contacted to ascertain how they distribute annual reports, and all reported that they mail their annual report to shareholders within two days of the date they send it to the SEC.

[9] Results from the FAF questionnaire suggest the dates analysts first see funds from operations are more dispersed (across investors) when the 10-K arrives at the SEC before the annual report than when the annual report arrives first. Some analysts indicate they use the first document released, while others rely on the annual report even if the 10-K is more timely. However, very few analysts claim to know funds from operations prior to either of these dates.

If the dates that the 10-K and annual report arrive at the SEC are clustered, the event-date proxy choice will not be as important. Moreover, even if these dates are widely separated, it may still be possible to select a suitable proxy if for most firms, the annual report precedes the 10-K. In this case either the annual report or the earliest date (one of these reports arrives at the SEC) is an acceptable choice. However, the 10-K and annual report dates are separated by more than five days for over 60 percent of the observations, and the annual report arrives at the SEC five or more days after the 10-K for more than one-third of the observations. These results may explain why the significance levels of some of the results reported later are affected by the width of the return interval at the funds release date.

In sum, the institutional evidence presented here suggests most firms' earnings and funds information releases are separate events, but that it is considerably easier to identify earnings announcements than it is to specify narrow return intervals that capture the price reactions associated with funds information. Reported results are based on return intervals centered on the date the annual report arrives at the SEC, but many of the tests in this study were repeated using both the date the 10-K arrives and the first date financial statements arrive at the SEC. Although test results are slightly less significant using these alternative proxies, none of the conclusions here are affected. The fact that the results are robust across these alternative event intervals suggests that future studies might improve upon the tests used here by specifying these event intervals more precisely.

Controlling for the Early Release of Component Information

Even if earnings and funds are announced at distinct dates, it will be difficult to distinguish the stock market reaction to the funds announcement from the reaction to the earnings announcement if the dates are close together. For over 90 percent of the observations in this study, the *Wall Street Journal* earnings announcements occurred at least eight trading days before the first date either the annual report or the 10-K arrived at the SEC, and these dates are separated by several weeks for most observations. However, to make certain the earnings and funds event intervals do not overlap, observations with fewer than eight trading days between these dates are eliminated from most tests and all results are checked for sensitivity to this choice.

Because all of the proxies for the

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[10] Both Disclosure Inc. and Bechtal provide these services. Prior to 1985 Disclosure Inc. was responsible for providing microfiche to the SEC within 10 days of the SEC arrival date. However, during the peak period at the end of March this requirement was frequently relaxed, and microfiche were not submitted until up to 15 days after the arrival date. When microfiche were sent to the SEC they were also sold to several demand customers. In 1985 Bechtal won the SEC contract to produce microfiche and now guarantees the SEC a turnaround of five days and seven days for non-peak and peak periods, respectively. However, each company provides photocopies to 25–40 clients within two days of the date the firm releases them.

funds announcement date are associated with dates when the firm formally submits audited financial statements to the SEC, there is an implicit assumption that firms do not release funds information earlier. A news release survey was used to classify firms according to the amount of predictive information released prior to the issuance of the audited statements.[11] This classification provides a control which increases the power of tests to detect a stock market reaction at the funds announcement proxy date. Most firms issue news releases shortly after the close of their fiscal years which contain, among other information, annual earnings and revenues. About five to ten weeks later, they release their audited financial statements which contain funds from operations. Some firms issue other news releases between these dates which include additional information useful for predicting funds from operations. Moreover, some earnings news releases provide information more suitable for this purpose than other news releases. Most contain annual corporate revenues and corporate earnings—total, per share, before and after taxes, and extraordinary items; many include segment data for revenues and earnings; some distinguish between operating and nonoperating earnings; and a few contain abbreviated financial statements which are sufficient for determination of both cash and working capital from operations.

Each of the 300 firms used in subsequent tests was requested to submit 1981 and 1982 (test years) news releases containing information about items in their annual financial statements. In all, 63 percent of the final sample of firms used in the subsequent tests sent news releases, and nearly 70 percent of these were from the 1981-82 sample period. All the firms except one that sent news releases for more than one year were classified identically each year in terms of the type of information in the releases. Thus, it seemed reasonable to use a more recent news release as a proxy to classify those firms which did not send a 1981-82 release. The fraction of firms in a given category is the same regardless of whether the news releases from outside the sample period (1981-82) are included. This supports the validity of using the more current news releases as proxies for those from the sample period. Those that sent news releases were classified as follows:

- Seventy-seven percent contained earnings, revenues, and additional information such as segment data but no other information deemed useful for forecasting funds from operations.
- Four percent contained the above plus additional line items on the earnings statement, including depreciation or deferred taxes.
- Thirteen percent contained preliminary earnings statements and balance sheets in either their annual earnings news release or in a subsequent news release issued prior to the date they formally submitted their financial statements to the SEC.
- Six percent issued a fourth-quarter report, at an unknown date subsequent to the earnings release but before the issuance of the audited statements.

Since the sample firms were randomly selected from the manufacturing firms in the 1982 COMPUSTAT file, the survey results are probably representative of large manufacturing firms generally. The results indicate most firms do not officially release funds from operations before they issue their audited financial statements. If more firms had released funds information at the earnings announcement date, it would have been possible to compare stock market reactions, at the date when audited financial statements are released, between the firms that did and did not release funds information at the earlier date. Too few firms issue preliminary abbreviated financial statements to allow formal inferences. However, for those firms that do issue them, there is no evidence of a reaction to the subsequent funds information when audited financial statements are released. There *is* evidence of such a reaction for firms that do not issue abbreviated statements. Moreover, tests concerned with measuring the stock market reaction to funds information at the date when audited financial statements are released may be more powerful if they are restricted to firms that do not issue preliminary abbreviated statements than similar tests that do not have this control.

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[11] That is, information which is useful for predicting annual funds from operations (other than annual earnings and revenues and items reported in previous interim reports).

ECONOMETRIC ISSUES

As in previous earnings studies, information content is determined here by examining the association between market model prediction errors averaged over an event period and forecast errors corresponding to accounting items released during this period.[12] Event periods of three and nine days are centered at the date the annual report arrives at the SEC, and funds component information is predicted using linear projections based on information known to investors at the beginning of the period. The closer these projections are to investors' conditional expectations, the more likely information content will be detected if it exists.[13] The suitability of these prediction equations is assessed by comparing their out-of-sample forecasting ability to competing models that resemble those used elsewhere. Information content is measured using regression and portfolio approaches. Both use a two-stage procedure where accounting forecast equations are estimated cross-sectionally in the first stage, and the association between the residuals from the first-stage regression and market model prediction errors is determined in the second stage. In one case, market model prediction errors are regressed cross-sectionally against the first-stage residuals, while in the other case, portfolios are formed according to the magnitude of the first-stage residuals; then their mean returns are compared. Although both procedures are similar to those used elsewhere, each has distinguishing features.

The regression procedure used here is unique in that the first-stage regressions are estimated cross-sectionally rather than over time for each firm. Sufficient conditions are introduced to ensure that the estimates for the second stage coefficients (which measure information content) are consistent, that the usual OLS t-tests are correct, and that a potential errors-in-variables problem associated with using estimates of the first-stage errors as regressors in the second stage does not occur.[14] Similar conditions have not been established in studies that use separate time-series regressions for each firm in the first stage. Thus, this cross-sectional procedure has a potential advantage, since the errors-in-variables problem could result in inconsistent estimates when (as is typically the case) short time series are used. However, there is a tradeoff: the coefficients in the cross-sectional procedure are assumed constant across firms, while those in the time-series approach are assumed constant across time. In this study the cross-sectional procedure must be used because of data limitations; but even if there were sufficient data, it is not clear that the time-series approach would be preferable. Considering all of the changes in accounting methods over the past 20 years and the problems associated with inflation, trends, and seasonality, the assumption of constant coefficients over time is bound to be violated. Even if these problems are not severe, the coefficient estimates still might be inconsistent because of the errors-in-variable problem.

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[12] Market model parameters are estimated for each firm-year using 120 consecutive daily returns from the fiscal year prior to the one under consideration. Specifically, if t represents the end of the previous year, then returns from day $t-90$ to $t-210$ were used. If returns were missing, additional ones from before $t-210$ were used. Parameters were also estimated using the procedures suggested in Scholes and Williams [1977] to assess whether the results were affected by nonsynchronous trading; they were not.

[13] The differences between a linear projection and a linear expectation involves the relation between the errors and regressors. For simplicity, assume $X=a+bW+\epsilon$. If $E[\epsilon|W]=0$ so that ϵ is mean independent of W, then $E[X|W]$ is linear. Even if $E[X|W]$ is not linear, it is still possible to form a "best linear" (in a population least-squares sense) predictor of X. The values of a and b that yield this best linear predictor correspond to the ϵ that satisfies the orthogonality condition $E[\epsilon W]=0$. In this case, $a+bW$ is frequently referred to as the linear projection of X onto W and is usually estimated using ordinary least squares. There is no assumption here that investors' conditional expectations are linear, but as Patell [1979] argues, information content is more likely to be detected, if it exists, when $a+bW$ is a good approximation to $E[X|\Phi]$ where Φ is investors' information at the beginning of the event period.

For the portfolio approach, H_0 is tested by comparing the difference in means across portfolios using a Hotelling T^2-test. However, the tests derived here differ in three ways from those used elsewhere: (1) information content is measured in event time rather than contemporaneously so the approach used by Kaplan and Patell is not appropriate; (2) differences across portfolio means are tested jointly instead of individually; and (3) some tradeoffs between power considerations and scope of inquiry are made explicit.

CROSS-SECTIONAL REGRESSION APPROACH

Let F represent fourth-quarter funds from operations and suppose investors' expectations about F at the earnings announcement can be approximated by a linear projection of F onto W, a vector of information available at the earnings announcement which is useful for predicting F. This prediction equation's forecast error, ϱ, is a proxy for new information about F released after the earnings announcement.[15] Further, let *ret* be a return metric measured over a short interval covering the funds announcement. Together, the projection of F onto W (hereafter the *accounting prediction equation*) and *ret* onto ϱ (hereafter the *return equation*) yield the following two-equation model:

$$F = BW + \varrho \qquad (1)$$

$$ret = \Gamma\varrho + \upsilon, \text{ and} \qquad (2)$$

$$E[W\varrho] = E[\varrho\upsilon] = 0, \qquad (3)$$

where 3 holds because the two equations are projections.

The coefficient, Γ, in equation 2 measures the extent to which market-adjusted returns respond to new information about accounting variables. For example, if $\Gamma \neq 0$, ϱ has information content, and the components of earnings have incremental information beyond earnings itself.[16] In particular, the *t*-statistic associated with Γ is used to test H_0.

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[14] Wilson [1986] contains a proof that the parameter estimates from this two-stage procedure are equivalent to certain generalized method of moment estimates and, if the error terms are homoscedastic, the usual OLS standard errors are consistent estimates for the asymptotic covariance matrix for the estimator. This implies the estimates of the coefficients in the model are consistent and their OLS t-statistics are correct. In the event the error terms are heteroscedastic, the standard errors in White [1980] are consistent estimates for the asymptotic covariance matrix for the estimator.

[15] For expositional convenience, the subsequent discussion refers to ϱ as new information about the funds component of earnings. However, the reader should keep in mind that ϱ also represents new information about the accrual component. If the accrual component is projected onto W, then B will change, but the regression error will be the same if earnings is included in W.

Before 2 and 3 can be used for prediction, W must be specified and a decision must be made concerning possible restrictions on B. For example, if F is earnings rather than funds from operations; W is the previous year's earnings; and B is restricted to be one, then equation 1 is a random walk. Similarly, Foster's [1977] quarterly-earnings-forecast models can be represented using equation 1 by defining W to be lagged quarterly earnings and restricting B in various ways.

A logical extension here would have been to use univariate prediction models for each of the dependent variables in this study. For example, fourth-quarter cash from operations could have been projected onto cash from operations from the previous four quarters. Each of the resulting forecasts would have been a restricted projection onto the regressors used here, with most of the coefficients restricted to be zero. Yet, without theoretical guidance, it seems inefficient *ex ante* to impose such restrictions. Instead, unrestricted versions of these projections are used here so that W contains fourth-quarter earnings and revenues for the current year, plus three lagged variables for each of the following: revenues; the noncurrent accruals; the difference between the total accruals and noncurrent accruals; and cash from operations. Lagged variables were from the third quarter, the first half of the current year, and the fourth quarter of the previous year.[17] Annual capital expenditures are also included in W to allow for expansions which might have substantial incremental effects.[18] By including the two lagged accrual variables and lagged cash from operations, the model, under suitable restrictions on B, implicitly contains lagged earnings and working capital from operations. Results are reported with and without these restrictions imposed. In addition, the out-of-sample forecasting ability of the unrestricted model is compared to several alternatives where various coefficients in B are restricted to be zero.

The discussion so far has pertained to a single firm. Model estimation requires additional assumptions about the cross-sectional properties of error terms and coefficients. The two-stage estimation method requires independent equation errors across firms and a cross-sectionally constant covariance structure for the accounting variables and returns. To make the first assumption more reasonable, market model prediction errors rather than raw returns are used for the dependent variable. In addition, to help ensure the second assumption, each accounting variable is divided by the total asset value (annual COMPUSTAT item 6) reported in the annual financial statements, at the end of the year in which the accounting variable is measured.[19] For example, third-quarter revenues are divided by total annual assets reported at the end of the fourth quarter, so that tests concerning cash flows versus earnings can now be interpreted as tests of cash recovery rate versus return on investment. Since the choice of a scale factor is arbitrary, most of the statistical procedures were repeated using the following alternative scaling factors: total market value of the firm's common shares at the end of the current year; average, over the previous five years, of the total asset value as reported in the financial statements; and average, over the previous five years, of the total market value of the firm's common shares. The conclusions are robust across these alternative scales, so most results are reported for current-year-total-asset scaling only.

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[16] However, if $\Gamma = 0$, ϱ may still have information content since Γ does not reflect the association between the higher order moments of ϱ and *ret*.

[17] For each item, the fourth-quarter measure is the annual number less the aggregate for the first three quarters.

[18] Thus, there is an assumption here that this item is available before annual earnings are published. This may be a reasonable assumption for most firms since capital expansion plans for the current year are frequently included in the previous year's annual report or announced in special news releases. However, all of the tests were repeated using capital expenditures for the first three quarters only and the results were not qualitatively different.

[19] The primary motivation for scaling is to make the constant covariance assumption more reasonable, not to control for heteroscedasticity. The robustness of the results to the homoscedasticity assumption is checked

Portfolio Approach

The regression model, 1-3, is one way to measure the association between stock returns, *ret*, and components information, ϱ. An alternative approach is to partition returns into portfolios according to the magnitude of ϱ. For two reasons, inference tests based on this approach may have more power to detect information content than the regression approach. First, portfolio-based tests are not as sensitive to outliers in ϱ. Outlier problems can be particularly troublesome for cross-sectional regressions involving returns and accounting variables, since the explanatory power of the regressions is so low. Second, portfolio-based tests are not as sensitive to nonlinearities in the relation between *ret* and ϱ. If these two problems do not exist, the portfolio approach may not be as powerful because it uses less information than the regression approach. For example, differences in mean returns within portfolios are not reflected in the results. The subsequent discussion presents the procedure used to assign observations to portfolios and the inference tests used to address the hypotheses of interest.[20]

Observations are partitioned into three portfolios using a one-way classification, based on the funds forecast errors. Partitions are then determined as follows: The sample mean and standard deviation of the funds forecast error are determined using all available observations. Two cut-off points are used to partition observations into three groups: low, medium, and high according to the magnitude of the forecast error. Forecast errors more than 0.5 standard deviations above the mean (of all observations) are classified as "high." Those forecast errors more than 0.5 standard deviations below the mean are labeled "low" and the remainder are classified as "medium." For each portfolio, $p=1, \ldots P$ and date t, market model prediction errors are averaged across all observations in the portfolio.[21] The results are

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using a procedure similar to that in White [1980]. In addition, an informal procedure is used to assess whether the covariance between dependent and independent variables is more similar across size after scaling. Five size portfolios are formed based on average market value over the sample period. The stability of the regression coefficients in equation 1 across these portfolios is then examined for both the scaled and unscaled variable cases. As expected, the regressions involving the scaled variables are more stable than those using the unscaled variables. For example, the coefficient estimates for the accounting prediction equation for unscaled cash from operations based on the full sample (462 observations) seem to be primarily determined by the observations in the two portfolios with the largest market values. In contrast, the coefficient estimates for the size portfolios are more stable for the prediction equations for scaled cash from operations.

[20] The approach used by Kaplan and Patell [1977] and Burgstahler and Noreen [1985] is not applicable here because the earnings and funds event dates are not aligned in chronological time.

[21] In this study, P is either three or nine depending on whether portfolios are based on a one-way or two-way classification. Two-way classifications are determined by first forming two one-way classifications based on earnings and funds and then assigning observations to one of nine portfolios according to the two one-way assignments.

then averaged over the event interval and the resulting $P \times 1$ vector is assumed to be distributed $N(v,\Sigma)$.[22]

The hypotheses in studies using a portfolio approach can be viewed as linear restrictions across the components of v. For any constant $q \times P$ matrix A the null $Av=0$ is rejected, at the α level of significance when

$$z'A'(ASA')^{-1}Az > T^2_{\alpha,q,Ne-q} = [(Ne-1)q/(Ne-q)]F_{\alpha,q,Ne-q}, \tag{4}$$

where the probability that a central F-statistic with degrees of freedom $(q, Ne-q)$ exceeds $F_{\alpha,q,Ne-q}$ is α, and where S is an estimate of Σ based on market model prediction errors from an $Ne=81$-day interval starting 170 days before the event date and extending until 90 days before the event date.

Moreover, if $Av=0$ is rejected, any number of subsequent tests of the form $CAv=0$, where C is any $1 \times q$ vector of constants, can be conducted without increasing the combined type one error, α, for all of these tests.[23] These additional tests are sometimes useful for providing insight as to which components of Av contributed to the rejection of $Av=0$. Each test has the same critical value as 4 and a rejection region of the form

$$z'A'C'(CASA'C')^{-1}CAz > T^2_{\alpha,q,Ne-q}. \tag{5}$$

Tests in Gonedes [1978], Kaplan and Patell [1977], and Matolcsy [1984] are a particular case of this approach. Each study begins its inquiry by testing $v=0$, which is equivalent to setting A equal to the identity. When this null is rejected, subsequent tests are conducted separately to determine if the hypotheses $v_j=0$ or $v_i=v_j$ can be rejected, where the subscripts are L (low), M (medium), or H (high). In contrast, this study defines A by

$$A = \begin{vmatrix} 1 & -1 & 0 \\ 0 & 1 & -1 \end{vmatrix}, \tag{6}$$

and tests $Av=0$ by using 4, which is equivalent to a joint test of $v_i=v_j$ *for all* $i \neq j$. When this hypothesis is rejected, 5 is used to test separately hypotheses such as $v_L=v_M$ and $v_M=v_H$. There are two advantages of defining A by 6 rather than the identity: (1) it permits the above joint test which cannot be represented as $CAv=0$ when A is the identity;[24] and (2) for most values of Ne and P the power of the individual tests of $v_i=v_j$ is higher when A is defined by 6 rather than the identity.[25] However, to get this increased power it is necessary to narrow the scope of inquiry, for when A is defined by 6 it is impossible to represent the hypothesis $\upsilon=0$ in the form $CA\upsilon=0$. At issue, then, is whether tests of $\upsilon=0$ help resolve the basic questions addressed by a study or are presented for completeness. In this study, descriptive statistics concerning mean portfolio returns are presented, but $\upsilon=0$ is not tested.

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[22] More precisely, at each date the $P \times 1$ vector of portfolio prediction errors is assumed to be distributed $N(v_t,\Sigma)$. Assuming these portfolios are independent over time, their average over the Nu days in the event interval multiplied by the square root of Nu is distributed $N(v,\Sigma)$ where v is the corresponding weighted average of the v_t's. Portfolio prediction errors are also assumed to be independent across portfolios, so Σ is diagonal. This assumption is reasonable here since observations are positioned in event time, but it is not required for any of the following results. These independence assumptions are consistent with those invoked in the regression inferences. However, the normality assumption is not required there.

[23] Additional details concerning simultaneous test procedures can be found in [Anderson, 1958; Johnson and Wichern, 1982; Miller, 1966; Morrison, 1967; Rao, 1973; Roy and Bose, 1953; Roy, 1954; 1956; and 1957].

[24] This means if A is the identity, this joint test cannot be conducted without possibly altering the type one error for the combined tests in some unknown way.

[25] This second result follows because, regardless of whether A is 6 or the identity, there exists a C for which $CAv=0$ reduces to $v_i=v_j=0$, and for both choices of A the left-hand side of 5 is the same, namely, the square of the usual t-test for the difference of two means. But clearly, since q is the number of rows in A, the right-hand side of 5 depends on the choice of A. Thus, tests where A is defined by 6 will be more powerful than those where A is the identity (since q is 2, rather than 3). When Ne is large relative to q, the size of the rejection regions in 4 and 5 can depend substantially on q. For example, if $Ne=80$, and $P=3$, then $T^2_{\alpha,q,Ne-q}$ is either 8.49, 6.32, or 4.00 depending on whether q is 3, 2, or 1, respectively. This indicates the extent of the power gains that can be achieved by limiting the scope of inquiry.

SAMPLE SELECTION, SCALING, AND OUTLIERS

The estimation method assumes the covariance structure for accounting variables and returns is constant across firms. To make this assumption more reasonable, the sample was restricted to the manufacturing firms (SIC codes 1,000 to 4,800). Initially 1,246 such firms were identified that had COMPUSTAT annual and quarterly records plus a CRSP daily record in the 1982 version of these databases. Of these, 245 were eliminated because specific items required for the subsequent tests were missing from these databases.[26] Three hundred firms were randomly selected from the remaining 1,001, providing 600 firm-year observations for 1981–82. However, 66 of these were dropped from the sample because 33 firms were not included in a later version of the COMPUSTAT data base.[27] In addition, 72 observations were dropped because 10-Qs were not available at Harvard's Baker Library for all of the quarters required for a specific firm-year observation, or because all of the required accounting items were not available. Estimates of the coefficients in the accounting prediction equations are based on the remaining 462 firm-year observations. Tests that required returns from the financial statement release date are based on the 379 firm-year observations for which both the annual report and 10-K SEC filing dates were available and for which the earlier of these dates followed the *Wall Street Journal* earnings announcement date by at least eight days. These firms were further classified into two groups according to the amount of balance sheet information disclosed in their earnings news release. Firms that included abbreviated balance sheets or line items such as depreciation in their earnings news releases are referred to as "early release" firms, while their complements are denoted "late release" firms. Firms that did not submit news releases were classified as late firms; thus some firms may be misclassified. Altogether, there were 322 late release and 57 early release firm-year observations.

To check for outliers and scaling sensitivity, each firm-year observation of each scaled accounting variable was compared to the cross-sectional mean, calculated using all available observations, and was eliminated if it was more than four standard deviations from the cross-sectional mean. On average, across different scaling factors, this procedure eliminated 23 firms.[28] All of the procedures involving estimation and inference were conducted using current-year-total-asset scaling with and without outliers. Most of these procedures were also conducted using all eight of the scaling-outlier combinations. *The major results in this research are robust across these eight combinations. For this reason, unless otherwise noted, results are reported for*

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[26] COMPUSTAT availability of the following items for 1978–1981 was required: Annual items—receivables, inventories, total assets, capital expenditures, total funds from operations, extraordinary items, and discontinued operations (COMPUSTAT items 3, 2, 6, 128, 110, and 124 respectively), and quarterly COMPUSTAT item 29—the date earnings and revenues are released. In addition, firms with more than ten missing stock returns over this period also were eliminated.

[27] Many of these firms were removed because of mergers, some of which occurred after the sample period. Thus, some of these observations could be saved by using the 1983 version of CRSP and COMPUSTAT.

[28] Some of the statistical procedures were also run using a three standard deviation cut-off. This eliminated about 20 more firms.

Table 1

Regression Results—Late Firms

Table Contents: The first three columns report the Γ-estimates, their related t-statistics, and the adjusted R^2s for equation 2 for the case where the regressor is the cash from operations forecast error. For each row the dependent variable is the average market model prediction error over the indicated interval where day zero is the date the annual report arrives at the SEC. Columns four through six contain similar results for working capital from operations. Depending on the availability of returns, the regressions are based on anywhere from 321 to 325 observations.

	Cash From Operations			*Working Capital From Operations*		
Return Interval	*Coefficient Estimate*	*T-statistic*	*Adjusted* $R^2 - \%$	*Coefficient Estimate*	*T-statistic*	*Adjusted* $R^2 - \%$
(−40, −32)	.011	1.35	.3	.050	1.99	.9
(−31, −23)	.009	0.97	0	−.019	−0.63	−.2
(−22, −14)	.005	0.59	−.2	.005	0.21	−.3
(−13, −5)	−.006	−0.81	−.1	.006	0.25	−.3
(−4,4)	.026	3.26	2.9	.029	1.10	.1
(5,13)	.005	0.48	−.2	.098	2.93	2.3
(14,22)	.012	1.46	.3	.024	0.88	−.1
(23,31)	.011	1.34	.2	.015	0.58	−.2
(32,40)	.017	1.79	.7	.036	1.20	.1

current-year-total-asset scaling only, with no outliers removed.

EMPIRICAL RESULTS

In this section, regression and portfolio results are presented for the late release firms first. Next, some condensed results are given for the early release firms.

Regression Results

The two-stage regression procedure discussed earlier was used to estimate equations 1 and 2. When funds are defined as *cash from operations*, the adjusted R^2 for 1 is 47.3 percent. Although both fourth-quarter earnings ($t = 2.26$) and revenues ($t = 2.82$) are significant, they add little to the overall explanatory power (the adjusted R^2 is 46.1 percent when these variables are excluded).[29] In contrast, when funds are defined as *working capital from operations*, the prediction equations with and without current year fourth-quarter earnings are considerably different from one another. When fourth-quarter earnings ($t = 22.73$) are included, the adjusted R^2 increases from 26.3 percent to 65.7 percent. The fact that fourth-quarter earnings are such a good predictor of working capital from operations may partially explain why there is insignificant evidence of incremental information content at the funds date for working capital from operations. If the magnitude of the forecast error for working capital from operations is insignificant relative to that for cash from operations, then its effect on stock returns at the funds date may be difficult to detect.

Table 1 contains the Γ-estimates, related t-statistics, and adjusted R^2 for equation 2. For each row the dependent variable is the average market model prediction error over the indicated nine-day interval, and the regressor for all rows is the forecast error associated with the prediction of funds, conditional on information released on or before the earnings release date. A nonzero Γ for the nine-day event interval, $(-4,4)$, is consistent with the hypothesis that the components of earnings have incremental information content over that of earnings itself.[30] Moreover, assuming ideal conditions for this research design, the Γ-estimates over the surrounding intervals should not be significant.[31]

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[29] Additional details about the prediction equations' coefficient estimates and t-statistics are in Wilson [1985]. In addition, Wilson [1986] contains similar results for the case where all of the regressors in W are included except fourth-quarter revenues and earnings.

For cash from operations the Γ-estimate is significant $(t=3.26)$ over the nine-day event interval, so H_0 is rejected at the 0.001 level of significance. Evidence from several related tests reflects the robustness of this result. First, as indicated in Table 1, the Γ-estimates are not significant in any of the pre-event or post-event intervals, so the result is probably not induced by measurement error in the cash from operations forecast error. Second, the *t*-statistic barely decreases $(t=3.11)$ when the homoscedasticity assumption is relaxed and the standard errors are calculated using White's procedure. Third, the Γ-estimate is 0.019 $(t=2.70)$ when nine-day event intervals are centered on the first date the 10-K or annual report arrived at the SEC, which is very close to the estimate for event intervals centered at the annual report arrival date. Fourth, when the variables in the accounting prediction equation, 1, are scaled by current-year-market-value rather than current-year-total-assets, the *t*-statistic increases to 3.90. Fifth, separate regressions for five portfolios based on market value all have positive Γ-estimates over the event interval. Moreover, this is the only return interval (of those reported in Table 1) where the signs of these five estimates are the same.[32] Sixth, the Γ-estimates over the event interval are quite similar for 1981 and 1982: 0.019 $(t=2.01)$ and 0.031 $(t=2.48)$, respectively. Seventh, the *t*-statistics over return intervals of various widths centered on the date the annual report

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[30] H_0 is also examined using a three-day interval centered on the date the annual report arrives at the SEC. For this shorter interval, the association between stock returns and either of the funds variables is not significant at an acceptable level. The *t*-statistics for the Γ-estimates are 1.24 and 0.16 for cash and working capital from operations, respectively. However, this outcome is sensitive to outliers. Once outliers are removed (using the procedure discussed in the section on sample selection, scaling, and outliers, the cash from operations coefficient is significant, regardless of the scaling factor used. When 21 outliers were removed, using a four standard deviation cut-off rule, the coefficient and *t*-statistic for the funds prediction error were .0289 and 3.83, respectively $(t_{299}(.001)=3.09)$. In contrast, the coefficient on the working capital from operations variable remains insignificant across all scaling-outlier combinations.

[31] Ideal conditions would include: (1) all investors have common expectations that coincide with the accounting prediction equation used here; (2) no information useful for predicting cash from operations is released between the earnings and funds date; and (3) share prices respond quickly to new information.

[32] Starting with the smallest market value portfolio, the Γ-estimates and their related *t*-statistics for the $(-4,4)$ return interval are 0.012 $(t=0.79)$, 0.041 $(t=2.37)$, 0.032 $(t=1.60)$, 0.054 $(t=1.54)$, and 0.015 $(t=0.62)$. The *t*-statistics for the non-event intervals partially explain why the event interval *t*-statistics are so small for the smallest and largest market value portfolios. For the largest market value portfolio the *t*-statistic is 3.27 over $(-31,-23)$, and this is the only interval where it is above 1.27. This is consistent with many larger firms' cash from operations information being known earlier, perhaps at the earnings announcement or around the auditor certification date. The *t*-statistics for regressions based on similar nine-day intervals, where the earnings announcement is day zero, are insignificant for intervals at and after the earnings announcement. Thus, either many large firms have another information event aligned with the annual report arrival date but not with the earnings announcement, or the result is due to random error. For the smallest market value portfolio, the absolute value of the *t*-statistic is below one for all intervals except $(5,13)$, where it is 1.47, which is close to the values for the three mid-size portfolios for $(-4,4)$. This is consistent with cash from operations information being impounded in price more slowly, perhaps because on average small firms' financial statements are disseminated more slowly among investors.

TABLE 2

DESCRIPTIVE STATISTICS FOR FUNDS PORTFOLIOS—LATE FIRMS

Portfolio Construction Rule: The entries in the first three columns are for a one-way classification based on the magnitude of the forecast errors from the prediction equation for cash from operations (ϱ in equation 1). Similarly, the entries in columns four through six are for a one-way classification based on the forecast errors for working capital from operations (see the discussion in the "Portfolio Approach" section). The means in the seventh column are for the combined portfolio which includes all observations.

Table Contents: The first row contains the average earnings forecast errors for the six portfolios described above, where the earnings forecasts are based on information available prior to the earnings announcement. The second and third rows contain the average cash from operations forecast errors and working capital from operations forecast errors, respectively, where these forecasts also use information in the earnings announcement (equation 1). Accounting variables are scaled by total assets so the low-cash portfolio has an average earnings forecast error of 1.4 cents per dollar of total assets.

Average Forecast Error	*Cash From Operations*			*Working Capital From Operations*			
	Low	*Medium*	*High*	*Low*	*Medium*	*High*	*All*
Earnings	.014	.005	−.016	−.028	.011	.007	.002
CFO	−.206	.004	.231	—	—	—	.008
WCFO	—	—	—	−.068	−.002	.063	−.002
Observations	86	151	85	66	188	68	322

arrived at the SEC are: five-day, 1.56; seven-day, 2.38; 11-day, 3.11; 13-day, 2.22; and 15-day, 2.06. This suggests the results are sensitive to the interval width, but significant for all widths between seven and 15 days. In addition, the results from the resampling procedure presented later provide strong evidence that the result is robust across the sample.

In contrast, the coefficient estimate for the working capital from operations forecast error for (−4,4) is insignificant across all scaling-outlier combinations and sample partitions discussed in the previous paragraph. Although the Γ-estimate is significant over (5,13), it is practically zero for this interval in 1981 (t=.06). Thus, it is determined entirely by observations in 1982 (t=3.16).

In the next section it is argued that this result is probably due to random error. Yet the sensitivity of this t-statistic to random error underscores the importance of checking whether the cash from operations result over (−4,4) is robust across this and other samples. The results from the resampling procedures presented in the section on additional evidence concerning the research design, the diagnostic checks reported earlier for specific sample partitions, and the portfolio tests in the next section all substantiate the cash from operations result for the sample used here.

Portfolio Results

Tables 2 and 3 and Figure 1 present the results from partitioning the sample according to the magnitude of the funds forecast error, where the forecast is conditional on information released on or before the earnings release date (ϱ in equation 1). The observations within both the early and late release subsamples were divided into three groups according to the magnitude of their funds forecast errors. Table 2 presents

Table 3

Cumulative Market Model Prediction Errors for the Funds Portfolios Over Selected Intervals—Late Firms

Portfolio Construction Rule: The cumulative returns in the first three columns are for a one-way classification based on the magnitude of the forecast errors from the prediction equation for cash from operations (ϱ in equation 1). Similarly, the cumulative returns in columns four through six are for a one-way classification based on the forecast errors for working capital from operations (see the discussion in the "Portfolio Approach" section). The cumulative returns in the seventh column are for the combined portfolio which includes all observations.

Table Contents: Cumulative market model prediction errors are provided for each of the above portfolios over the specified intervals where day 0 is the date the annual report arrives at the SEC. The entries are in tenths of a percent. Thus, the high-cash portfolio had a 2.5 percent cumulative market model prediction error over the nine-day interval (−4,4).

Return Interval	*Cash From Operations*			*Working Capital From Operations*			
	Low	*Medium*	*High*	*Low*	*Medium*	*High*	*All*
(−10,−5)	−4	3	3	−10	3	7	1
(−4,4)	−12	0	25	9	0	7	3
(5,10)	11	7	1	−10	6	25	7

descriptive data about the three portfolios for each funds variable, Figure 1 plots these portfolios' cumulative abnormal returns over a 21-day interval centered on the date the annual report arrives at the SEC, and Table 3 presents these portfolios' cumulative abnormal returns for select subintervals of this 21-day period. For comparison purposes, the average earnings forecast errors, conditional on information released prior to the release of earnings, are also reported in the first row of Table 2.[33] Each entry in the first three rows of Table 2 is the average forecast error for an accounting variable scaled by total assets.[34] If there are systematic post-earnings announcement drifts in security returns, as reported in the literature, and funds and earnings forecast errors are positively correlated, then a difference in mean returns across funds levels might be due to the release of earnings information.[35] The results in Table 2 suggest that there may be a positive association between the funds and earnings forecast errors when funds is defined as working capital from operations and a negative association when funds is cash from operations. However, the correlation in these portfolios is probably quite small because, by construction at the individual security level, the funds forecast errors are perfectly uncorrelated with the earnings forecast errors.[36] The results in

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[33] The earnings forecasts were based on an equation similar to 1 with fourth-quarter earnings and revenues removed from *W* and *F* replaced by fourth-quarter earnings.

[34] For example, the average earnings forecast error for the low earnings portfolio is .014, indicating 1.4 cents per dollar of assets.

[35] Foster, Olsen, and Shevlin [1984] considered the possibility of post-announcement drift and reviewed the findings in their studies.

[36] This follows because the funds prediction equation includes all of the regressors in the earnings equation plus earnings and revenues, and because the coefficients in both equations are unrestricted. It is also possible that spurious correlation between the market prediction errors at the two event dates could be induced if the parameters in the market model shifted over the interval between the estimation period and event dates. However, the correlation between these return metrics is only 0.029.

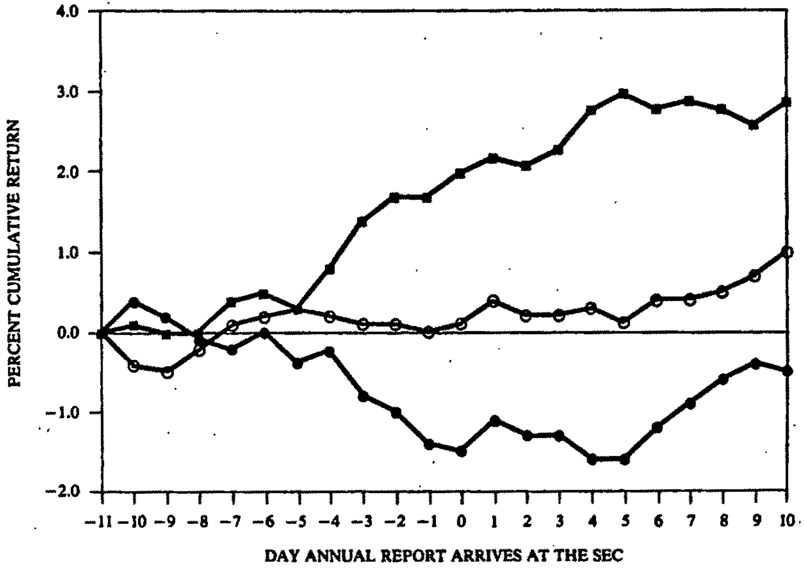
FIGURE 1

THE CUMULATIVE MARKET MODEL PREDICTION ERRORS FOR THE FUNDS PORTFOLIOS—LATE FIRMS

Figure Contents: The cumulative prediction errors in the top (bottom) graph are for a one-way classification based on the magnitude of the forecast errors from the prediction equation for cash (working capital) from operations. For each graph, observations are partitioned into three portfolios: low, medium, and high according to the magnitude of the forecast error (see the discussion in the "Portfolio Approach" section). Cumulative market model prediction errors starting ten days before the annual report arrives at the SEC (day 0) are provided for each portfolio.

CASH FROM OPERATIONS PORTFOLIOS

Cumulative Prediction Errors



WORKING CAPITAL PORTFOLIOS

Cumulative Prediction Errors

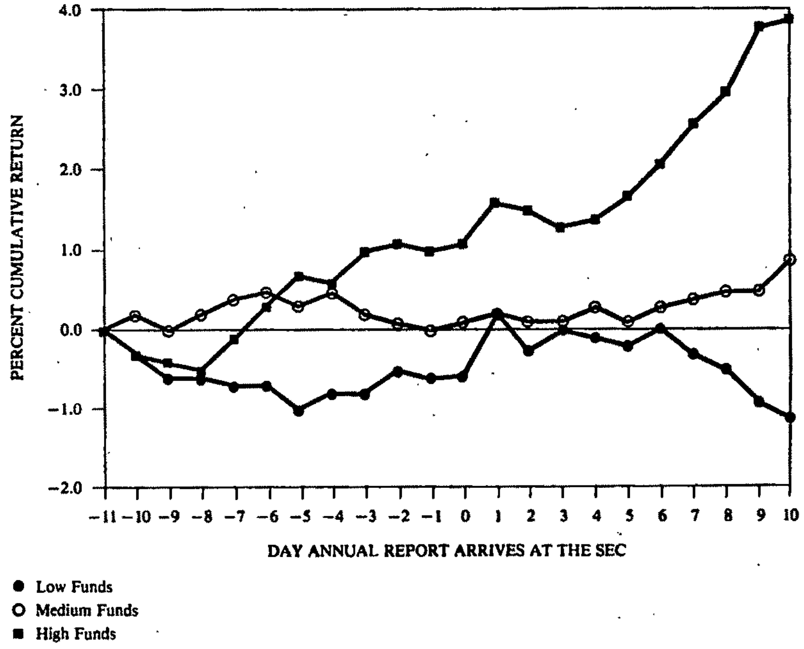


Table 3 also suggest that the differences in mean returns across the cash from operations portfolios are not due to a post-announcement earnings drift. If the cumulative returns of the cash from operations portfolios are nonzero over (−4,4) because of a post-earnings announcement drift, then the effect should be noticeable over the interval closest to the earnings announcement, (−10, −5). However, none of the portfolios exhibits a large cumulative return over this interval.

The results in Figure 1 indicate that, for both funds definitions, the cumulative market model prediction errors over the entire 21 days are positively associated with the funds forecast errors. For the cash from operations portfolios, the respective average (across firms within a portfolio) cumulative prediction errors are −0.5 percent, 1.0 percent, and 2.9 percent for the low, medium, and high cash from operations portfolios. Similarly, the average cumulative prediction errors across working capital from operations portfolios are −1.1 percent, 0.9 percent, and 3.9 percent. Moreover, the average cumulative return for all of these observations is 1.1 percent. Thus, over this extended period the difference across working capital from operations portfolios seems more pronounced than the difference across cash from operations portfolios.

When this 21-day period covering the funds announcement is divided into three subperiods as in Table 3, the magnitudes of the effects within subperiods differ across funds definitions. In particular, the difference across cash from operations portfolios is most pronounced over intervals centered on the event date, such as (−4,4), whereas the difference across working capital from operations portfolios is more pronounced over the intervals (−10, −5) and (5,10).[37] This pattern is consistent with that reported in Table 1 for the Γ-estimate's *t*-statistics. The differences in average cumulative prediction errors between the high-working capital from operations and low-working capital from operations portfolios at days −5, 4, and 10 are 1.7 percent, 1.5 percent, and 5.0 percent respectively, whereas the comparable differences across cash from operations portfolios are 0.7 percent, 4.4 percent, and 3.4 percent. The average cumulative return for the combined portfolio (all observations) over the 21-day period is strongly influenced by returns over the (5,10) period. Next, evidence will be provided which indicates this unusual activity over (5,10) may be due to random sampling error.

Two extreme returns (43 percent and 54 percent) over (5,10) are largely responsible for the positive cumulative returns for the low-cash from operations (1.1 percent), medium-cash from operations (0.7 percent), and combined portfolios (0.7 percent). In addition, over half of the returns are negative for each of these portfolios, which further illustrates that these positive cumulative returns are due to these two outliers. In contrast, the positive cumulative return for the high-working capital from operations portfolio (2.5 percent) over (5,10) seems to be associated with a positive shift in the return distribution. However, like the regression tests, the cash flow results over (−4,4) are consistent for both 1981 and 1982, while those for the working capital portfolios over (5,10) are not.

Taken at face value, these results suggest that, at least for 1982, there was a delayed stock market reaction to working capital from operations. Yet it seems unreasonable to believe it would take longer for the working capital from operations information to be assimilated into the stock price than it would for the cash from operations information. If anything, one would expect that analysts find it more difficult to determine cash from operations since it is frequently not a line item on financial statements, whereas working capital from operations is. Alternatively, there may be a cross-sectional dependency in the data or sampling error. For instance, if observations are aligned in real time or there is a common information event over (5,10), such as the first quarter's earnings announcement, then there could be a cross-sectional dependency. The real time alignment problem seems unlikely since the effect is limited to a specific sub-interval and since the annual report release dates are dispersed across years and calendar months.[38] An examination of the *Wall Street Journal Index* over (5,10) for the firms in the high-working capital from operations portfolio indicated that there was no common information event across firms and very little evidence of unusually good news.[39] In summary, the effects over (5,10) remain unexplained but seem to be due to random error.

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[37] The positive cumulative residual for the low-working capital from operations portfolio over (−4,4) is somewhat surprising, but not statistically significant ($t = 1.01$).

Additional descriptive evidence based on the quartiles for the cumulative returns within each portfolio over (−4,4) also suggests that there is a more substantial difference across the three cash from operations portfolios' market model prediction errors than across the working capital from operations portfolios'. Within each portfolio the cumulative market prediction error was calculated for the nine-day period. Next, the first quartile, median, etc. of these cumulative returns was determined. For the cash from operations portfolio the measures increase from the low to the high cash from operations portfolios for each quartile. This suggests the subsequent tests are not being driven by outliers. In the working capital from operations case there is no such consistency.

Table 4 presents the T^2-statistics of tests for a difference across means, for each funds variable, across these same subintervals. By inequality 5 in the "Portfolio Approach" section, the null hypothesis $v_i = v_j$, for specific values of $i \neq j$, is rejected at the .05 level whenever $T^2 > 6.32$. The entries in Table 4 indicate that when the rejection regions are properly specified to account for the fact that several tests are being conducted simultaneously, none of the individual differences are significantly different from zero at the 0.05 level. However, several of these differences would have been classified as significant if the rejection regions had not been corrected to account for simultaneous testing. As indicated in the "Portfolio Approach" section, these tests do not test the *joint* hypothesis that there is no difference across the means of all three portfolios. This hypothesis was tested using the T^2-statistic in inequality 4. The value of the T^2-test was 9.36, which indicates a significant difference in mean portfolio returns at the 0.025 level ($T^2_{0.025,2,80} = 7.90$) across portfolios based on cash from operations. In contrast, the value of the T^2 was 1.22 for a similar test using portfolios based on

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[38] For example, no calendar month for a specific year contained more than seven of the 68 observations in the high-working capital portfolio. More generally, 20 percent of the observations' annual report arrival dates at the SEC were in March 1982, 19 percent in March 1983, ten percent in April 1982, 11 percent in April 1983, and 40 percent were spread uniformly over the remaining months.

[39] First-quarter earnings announcements were more than 15 days after the annual report for 62 of the observations in the high cash portfolio. Only three firms had earnings announcements during (5,10). Loosely speaking, a few more firms appeared to release good news than bad, but for the majority of firms there was no sign of unusual activity.

TABLE 4

T^2-TESTS FOR COMPARISON OF MEAN RETURNS ACROSS DIFFERENT FUNDS LEVELS—LATE FIRMS

Portfolio Construction Rule: The T^2-statistics in the first three columns are for a one-way classification based on the magnitude of the forecast errors from the prediction equation for cash from operations (ϱ in equation 1). Similarly, the T^2-statistics in columns four through six are for a one-way classification based on the forecast errors for working capital from operations (see the discussion in the "Portfolio Approach" section).

Table Contents: T^2-statistics are provided for a test for a difference of means across the specified portfolio pairs over the specified time intervals (this is an application of inequality 5). Average returns, both across portfolios and time, are measured over intervals specified relative to the date the annual report arrives at the SEC (day 0). For example, the T^2-statistic for the comparison between the high-cash and low-cash portfolios over a six-day interval starting five days after the annual report arrived at the SEC is 0.50. The null hypotheses are rejected at the .05 level of significance whenever $T^2 > 6.32$.

	Within Cash Flow			*Within Working Capital*		
Return Interval	*Medium Minus Low*	*High Minus Low*	*High Minus Medium*	*Medium Minus Low*	*High Minus Low*	*High Minus Medium*
(−2,2)	0.42	0.79	0.19	0.34	0.00	0.29
(−4,4)	0.72	4.37	2.62	0.22	0.01	0.21
(−10,−5)	0.37	0.25	0.00	1.25	1.21	0.94
(5,10)	0.05	0.50	0.38	1.89	5.20	2.34

working capital from operations.

To validate the regression and portfolio findings, similar tests were conducted using the 57 "early release" firms —those that release significant balance sheet information in their earnings news release. When equation 2 was estimated for this subsample over (−4,4), the Γ-estimate was essentially zero ($t=0.03$). Likewise, the portfolio means for the three portfolios based on the magnitude of the cash from operations forecast errors were also insignificant.[40] Because of the small sample size, these regression and portfolio tests are probably not powerful enough to reject H_0 even if it is false. However, these results are weakly consistent with the premise that cash from operations information for early release firms is assimilated into stock price before the annual report is released.

Additional Evidence Concerning the Research Design

Hold-out tests and resampling procedures are conducted to assess the robustness of the findings to the specification of the accounting prediction equation for cash from operations. They are also used to compare the standard error of the Γ-estimate's sampling distribution to the asymptotically correct standard error used to determine the t-statistic reported earlier. In addition, the validity of the research design is checked by comparing the cash from operations portfolio returns at the earnings and funds announcement dates. According to the assumptions underlying the research design, there should not be an association between ϱ (the regression error in equation 1) and earnings announcement returns. Similarly, returns at both dates are compared for portfolios based on the magnitude of earnings forecast errors, where the forecasts are conditional on information released prior to the earnings announcement. In this case, if the stock market is efficient with respect to earnings, the funds announcement returns on these portfolios should be zero.

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[40] The early release firms were partitioned into three cash from operations portfolios using the same cut-off points as the "late release" firms. There were 18, 22, and 17 observations, respectively, in the low, medium, and high cash from operations portfolios and their cumulative returns over a nine-day interval centered at the annual report release date were 0 percent, 2.3 percent, and 1.6 percent. All of the T^2 tests reported above for the late release firms were insignificant for these early release firms.

Four accounting prediction equation alternatives are considered for cash from operations: the unrestricted version of 1 used to determine the results reported earlier and three restricted versions. The first restricted version's regressors are the three lagged cash from operations items plus the current year's fourth-quarter earnings and revenues. The second includes the lagged cash from operations items only. The third is a random walk based on the previous year's fourth-quarter's cash from operations.

The subsequent comparisons are based on 60 partitions of the 462 observations used to estimate the accounting prediction equations. Each partition is selected using a program which essentially flips a fair coin 462 times and assigns an observation to the estimation (hold-out) subsample if the outcome is heads (tails). Accordingly, the subsamples have varying sizes that average 231 observations. For each partition, the competing prediction models are estimated using the estimation subsample. Their out-of-sample forecasting abilities are compared in the corresponding hold-out subsample. For each partition and competing prediction model, the out-of-sample prediction errors are determined using accounting variables from the holdout subsample, and prediction equation coefficients are estimated using the estimation subsample. Forecasting comparisons are based on the mean absolute error and mean square error criteria suggested in Foster [1986]. For each prediction model and partition, the mean absolute and mean square errors are calculated and their average and standard deviation over the 60 partitions are determined. In addition, for each partition the competing model with the smallest mean absolute error is determined, as is the one with the smallest mean square error. For each criterion, the percent of time each model is ranked first across the 60 partitions is then determined. The first six columns of Table 5 present these findings. Clearly, the random walk model, *RW*, which is based on the previous year's fourth-quarter cash from operations, is inferior relative to the competing models, as an out-of-sample forecaster of the current year's fourth-quarter cash from operations. The average standard deviation of the mean square errors for the random walk is twice as large as its competitors. There is not a single partition where it is ranked first using either criterion. Although the unrestricted version of 1, *UNR*, which is used for the tests reported earlier, is ranked first using the mean square (absolute) criterion for 59 (70) percent of the partitions, the other two models which used three lagged cash from operations terms are close competitors. Indeed, the averages and standard deviations for both criteria are smallest for the unrestricted model, but the margin is very small. Thus, the unrestricted model certainly does no worse at out-of-sample

TABLE 5

COMPARING THE OUT-OF-SAMPLE FORECASTING ABILITY AND INFORMATION CONTENT EVIDENCE OF COMPETING CASH FROM OPERATIONS PREDICTION MODELS

Table Contents: Sixty estimation subsamples and corresponding holdout subsamples were chosen from the 462 observations used to estimate the accounting prediction equations. For each partition, four prediction models were estimated and their out-of-sample prediction errors were determined using estimation sample coefficient estimates and accounting variables from the hold-out sample. These include an unrestricted version of equation 1, *UNR*, which uses the 15 regressors specified in the "Cross-Sectional Regression Approach" section, and three restricted versions: *LAG+* which contains three lagged cash from operations terms plus the current year's fourth-quarter earnings and revenues, *LAG* which contains lagged cash from operations only, and *RW*, a random walk based on the previous year's fourth-quarter cash from operations. For each partition, the out-of-sample mean squared error and mean absolute error are calculated. The first two columns contain the mean and standard deviation of the mean square errors for the 60 samples, and the third column contains the percent of samples where the corresponding model had the smallest mean square error. Columns four through six contain equivalent comparisons based on the mean absolute errors. Columns seven and eight pertain to the 60 hold-out sample estimates of Γ in equation 2. They contain the average *t*-statistics and percent of times these *t*-statistics exceed 2.00.

	Mean Squared Error			*Mean Absolute Error*			*t-statistics for* Γ	
Forecast Equation	*Mean*	*Standard Deviation*	*Percent Ranked First*	*Mean*	*Standard Deviation*	*Percent Ranked First*	*Mean*	*Percent Greater Than 2.0*
UNR	.0042	.0006	59	.044	.002	70	2.22	57
LAG+	.0043	.0007	14	.045	.002	10	1.43	22
LAG	.0043	.0007	27	.045	.002	20	1.12	10
RW	.0080	.0018	0	.052	.004	0	1.98	51

forecasting than alternatives that resemble those used in previous earnings studies, and does significantly better than a random walk model.

These 60 partitions also are used to establish a sampling distribution for the Γ-estimates. For each partition and prediction model, equation 2 is estimated using hold-out subsample returns and out-of-sample prediction errors.[41] The last two columns of Table 5 contain the average *t*-statistics for these Γ-estimates across the 60 partitions and the percent of time these *t*-statistics exceed 2.0, respectively. Nearly 60 percent of the *t*-statistics for the Γ-estimates exceed 2.0 when the cash from operations forecast errors are determined using the unrestricted model and the average *t*-statistic is 2.22. This is strong evidence that the results reported earlier are not driven by outliers. In addition, the average and standard deviation of these 60 Γ-estimates are 0.23 and 0.00959, which are comparable to those for the entire sample (0.26 and 0.00798). This implies that the *t*-statistic reported earlier for the entire sample, 3.26, is only reduced to 2.71 (.026/.00798) when the standard error of the sampling distribution (rather than the asymptotically correct standard error) is used, suggesting the rejection of H_0 is not sensitive to the finite sample size limitation.[42]

Somewhat surprisingly, the out-of-sample forecasting ability of the four models is not directly related to the frequency of times the hold-out *t*-statistic exceeded 2.0. The best forecaster, the unrestricted model, also has the largest percent of *t*-statistics over 2.0 and the largest average *t*-statistic (2.22). However, the random walk model, by far the worst forecaster, has a median *t*-statistic of nearly 2.00. This finding is analogous to the Hughes and Ricks [1985] finding that the change in fourth-quarter earnings from one year to the next has incremental information content beyond analyst forecast errors at the earnings announcement. However, here when the returns from the funds announcement are regressed against both forecast errors, using the full sample of 322 observations, the coefficient on the forecast error related to the random walk is not significant ($t=0.94$), while the coefficient related to the unrestricted model is ($t=2.20$).

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[41] Since only 322 of the 462 observations have returns, these subsamples, on average, contain 161 observations.

[42] Laurentius Marais suggested using the standard error of the estimate's sampling distribution to assess the robustness of the results to the finite sample size limitation.

The small average *t*-statistic reported in Table 5 for the regressions where the forecast errors are based on lagged cash from operations plus current revenues and earnings ($t=1.43$), and lagged cash from operations only ($t=1.12$), suggest that the conclusions here might be sensitive to the forecast model choice. However, these statistics increase ($t=2.11$ and $t=1.68$, respectively) when all 462 observations are used to estimate the prediction equations and 322 observations are used for the return equations. Both these full sample *t*-statistics are smaller than the corresponding regression where the forecast errors are based on the random walk ($t=2.66$). However, the results of the study would have been significant for all of the prediction models except the one whose regressors are lagged cash from operations only.

Assuming that cash from operations has information content, and that ideal conditions for this research design exist: (a) there should *not* be an association between stock returns at the earnings date and ϱ since cash from operations is needed to determine this forecast error and is assumed to be released later at the funds date; and (b) there should *not* be an association between stock returns at the funds date and unexpected earnings. In addition, if positive unexpected earnings and positive unexpected cash from operations (where the expectation is conditional on knowing earnings) are both good news, then portfolios with low (high) unexpected earnings and high (low) unexpected cash from operations should have returns with opposite signs at the earnings and funds date. The results provided next further examine the validity of the two-date research design by considering the extent to which these implications hold.

Table 6 presents the return behavior for both the earnings and cash from operations portfolios over event intervals centered at the *Wall Street Journal* earnings announcement and the date the annual report arrives at the SEC. Clearly the *Wall Street Journal* earnings announcement is more of an earnings event than a cash from operations event, while just the opposite is true at the date the annual report arrives at the SEC. At the earnings announcement the difference between the cumulative market model prediction errors for the high and low earnings portfolios is 3.1 percent as compared to 1.4 percent for the high and low cash from operations portfolios. In contrast, this difference at the funds date is 0.5 percent for the earnings portfolios and 3.7 percent for the cash from operations portfolios. There is some evidence of an early reaction to unexpected cash from operations at the earnings date and of a persistent reaction to unexpected earnings at the funds date, but neither is statistically significant. At the earnings

TABLE 6

COMPARISON OF THE CUMULATIVE MARKET MODEL PREDICTION ERRORS FOR THE EARNINGS AND FUNDS PORTFOLIOS AT BOTH EVENT DATES—LATE FIRMS

Portfolio Construction Rule: The cumulative returns in the first eight rows are for portfolios based on one-way classifications. Cash from operations portfolios are based on the magnitude of the forecast errors from equation 1. The earnings portfolios are based on a similar equation with fourth-quarter earnings and revenues removed from W, and F defined as fourth-quarter earnings. Two-way classifications are determined by first forming two one-way classifications based on earnings and funds, and then assigning observations to one of nine portfolios according to the two one-way assignments.

Table Contents: Each column contains cumulative market model prediction errors measured over the specified interval. The "earnings announcement" interval includes the day of and the day before the *Wall Street Journal* earnings announcement. The "annual report release date" interval is a nine-day period centered on the date the annual report arrives at the SEC. The entries are in tenths of a percent. For example, the high-cash portfolio had a 2.5 percent cumulative market model prediction error over the annual report release date interval. Some of these results are also in other tables and are provided here for convenience.

	Event Intervals			
	Earnings Announcement 2-Day Interval		*Annual Report Release Period 9-Day Interval*	
Portfolios	*Observations*	*Market Model Prediction Errors*	*Observations*	*Market Model Prediction Errors*
Earnings				
Low	43	−13	43	−4
Medium	209	−2	210	2
High	69	18	69	10
High-Low		31		14
Cash From Operations				
Low	85	0	86	−12
Medium	151	−3	151	0
High	85	5	85	25
High-Low		5		37
Cash From Operations-Low and Earnings-High	20	12	20	−17
Cash From Operations-High and Earnings-Low	19	−19	19	30

announcement, T^2 is 4.71 ($T^2_{0.025,2,80}=$ 7.90) for a joint test for a difference in mean market model prediction errors across the cash from operations portfolios and 23.81 for a similar test across the earnings portfolios. For similar tests at the funds date, T^2 was 9.36 for the cash from operations portfolios and 0.872 for the earnings portfolios.[43]

Table 6 also indicates there are return reversals at the funds date for portfolios with unexpected earnings and cash from operations at opposite extremes. Portfolios with high earnings and low cash from operations have a cumulative market model prediction error of 1.2 percent at the earnings announcement and −1.7 percent at the funds date, while the low-earnings and high cash portfolio returns at these dates are −1.9 percent and 3.0 percent, respectively. Because these portfolios only contain a few observations, the standard errors related to their returns are relatively large. As a result, these returns are not statistically significant. However, these findings support the validity of the two-date design, and they indicate that one of the ways this study could be improved is by using more observations.

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[43] These results are reported here in a descriptive rather than inferential spirit to illustrate the validity of the research design. The combined type one error reported earlier, for the hypotheses tests which are of primary interest in this study, does not cover joint inferences concerning the statistics reported here.

SUMMARY AND POSSIBLE EXTENSIONS

This study addressed the question of whether the accrual and funds components of earnings have incremental information content beyond earnings itself. It has provided significant evidence that the answer to this question is affirmative when funds are defined as cash from operations. However, the findings are inconclusive if funds are defined as working capital from operations.

A model was used to determine if the components of earnings have incremental information content beyond earnings itself. It measures the association between market model prediction errors from an event interval covering the date the annual report arrives at the SEC and new information about the accrual and funds components of earnings released at that time. Market model prediction errors were summed over an event interval centered on the date the annual report arrives at the SEC, and the resulting sum was regressed separately against new information about working capital and cash from operations. For a nine-day event interval, the cash from operations regression coefficient was positive and significantly different from zero, whereas the working capital from operations was not significant. A portfolio approach also was used to measure the information content of the components of earnings at the annual report release date. For each funds variable the sample was partitioned according to the magnitude of the funds forecast error. Then, the mean market model prediction errors for the resulting portfolios were compared over various return intervals. When funds were defined as cash from operations and a nine-day event interval was used, there was a significant difference in the mean market model prediction errors across portfolios. In addition, the portfolio ranking based on the magnitude of the cash from operations forecast errors was the same as the rankings based on the mean, median, first quartile, and third quartile of the market model prediction errors across portfolios. These findings indicate that total accruals and cash from operations, taken together, have incremental information content beyond earnings and that there is a positive association between this component information and stock returns. The fact that information content was detected for cash from operations but not for working capital from operations might explain why others, using funds variables which are highly correlated with earnings, have not found evidence that funds have incremental information content.

The evidence here is consistent with the stock market reacting to the new information in the cash from operations and total accrual components of earnings. However, to the extent that there are other correlated items in the annual report, this causality argument is mitigated. One such correlated variable, the current year's capital expenditures, is partly controlled for in this study, but clearly there could be others. Also of interest is whether there are uncorrelated items in the annual report that have information content. A possible extension would be to combine some of the features here with those used by Hoskin, Hughes, and Ricks [1986], who assess the incremental information content of items released concurrently with earnings. Besides addressing these omitted variables issues, such a study should replicate the tests here to see if the results are robust across different firms and years.

One explanation for the results concerning cash from operations is that investors reward firms for being responsive to demand swings in their products. For instance, if during the current period investors believe that demand is going to expand in the near future, they might reward firms that anticipate this demand by expanding their inventories and receivables and, as a result, reduce cash from operations. Similarly, firms which respond to anticipated downturns by reducing inventories and receivables and thus increasing cash flows may also receive a premium from investors. This interpretation is consistent with the findings here, since the association between stock returns and unexpected cash from operations was positive during the two-year sample period when the economy was in a severe downturn (1981–82). Moreover, this perspective suggests that a similar study covering an extended period might find a systematic change in the sign of the correlation between returns and unexpected cash from operations, depending on the state of the economy. This "responsiveness" interpretation is different from the standard "liquidity" argument which would claim that cash from operations has information content because it signals financial distress. Although cash from operations may be useful for assessing credit worthiness, it seems unlikely that there would be a sufficient number of distressed firms in the random sample used here to explain the results.

Some members of the financial community may find these results useful since their decisions are influenced by their perception of how stock price is affected by various accounting variables. Although this study finds that the cash and noncash components of earnings, taken together, have incremental information content beyond earnings, it has no implications for which one of these components (if not both) has information content. After controlling for earnings, incremental information about the cash and noncash components of earnings is precisely the same.

This study has been extended in Wilson [1986], which introduces a model to address the question of whether accruals have incremental information content beyond cash flows. It structures the way information about the components is extracted from earnings when earnings are announced. In addition, it links the association between this component information and stock returns at the earnings announcement to the association between stock returns and the common component information released on the date the annual report arrives at the SEC. This related study confirms the finding here that the cash and total accruals components of earnings have incremental information content beyond earnings itself, and also finds that the total accruals component of earnings has incremental information content beyond the cash component.

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Modeling Judgments of Taxpayer Compliance

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ABSTRACT: The purpose of this study is to test the feasibility of using a model derived from the judgments of a group of tax experts in controlled experimental conditions to predict actual compliance behavior. A judgment model, using amount of income, source of income, penalty for cheating, and rate structure as independent variables, was derived from CPA tax professionals. The model then was used successfully to predict actual taxpayer compliance using IRS Taxpayer Compliance Measurement Program data. The model also was used to infer the relative importance of the determinants of taxpayer compliance used in the study. Source of income was found to be about three times more important than the next most heavily weighted variable. These results demonstrate the potential for employing a derived judgment model as an efficient means of predicting the effect of proposed changes in tax policy on taxpayer compliance.

TAX evasion is a serious and growing problem in the United States. The Treasury Department has estimated that the amount of revenue lost through income tax evasion (the so-called "tax gap") was $81.5 billion in 1981, or almost 90 percent of that year's budget deficit. Individual filers accounted for $65.6 billion of this amount. Estimated legal sector voluntary compliance rates (income taxes paid/income taxes owed) dropped from 84 percent in 1973 to less than 81 percent in 1981 [IRS, 1983]. This trend, as well as the size of the tax gap, suggests a need to provide policy makers on a timely basis with a better understanding of the factors that affect income tax compliance.

In recent years, a number of researchers have addressed the issue of factors that affect tax compliance. Research methods employed have included development of analytical models [Allingham and Sandmo, 1972; Srinivasan, 1973], survey research [Spicer and Lundstedt, 1976; Song and Yarbrough, 1978; Westat, Inc., 1980; Mason and Calvin, 1984], regression modeling [Clotfelter, 1983; Witte and Woodbury, 1985], and experimental studies [Friedland, Maital, and Rutenberg, 1978; Spicer and Becker,

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1980; Jackson and Jones, 1985; and Milliron, 1985]. A variety of factors affecting tax compliance have been included in these studies. These factors include income level, income source, penalty for cheating, probability of detection, attitudes toward cheating, complexity of the law, tax rates, and personal characteristics of taxpayers such as age and sex.[1]

The present study belongs in the experimental category. Our purpose was to test the feasibility of using a model derived from the judgments of a group of tax experts in controlled experimental conditions to predict actual compliance behavior. Such models could be used to predict the effect of various factors on taxpayer compliance in cases where actual (environmental) compliance data are unavailable. Thus, this approach should be particularly useful as an efficient means of predicting the effects of proposed changes in tax policy on taxpayer compliance.

In the first phase of the study we performed a laboratory experiment to test alternative models of the judgment behavior of tax professionals concerning how four factors affect taxpayer compliance. The purpose of the experiment was to determine which of these models best described their behavior. We hypothesized that experts in taxation, who are taxpayers as well as tax advisors and tax return preparers, have, by virtue of their training and experience, considerable knowledge and understanding not only of factors that influence taxpayer compliance but also how they interact to affect compliance.

In the second phase of the study we conducted a limited test of the external validity of the model derived in phase one by using it to predict actual taxpayer compliance behavior using data obtained from the IRS through its Taxpayer Compliance Measurement Program (TCMP). These data are the best available estimates of compliance among taxpayers who file returns.[2]

METHOD

Our basic approach is inductive. We derived a judgment model from one group of subjects (CPAs specializing in taxation) in an experimental setting and subsequently used the model to successfully predict the behavior of a different group of people in a real-world setting (taxpayers included in the IRS TCMP file). Thus, we combined a laboratory experiment to test alternative models with (partial) validation of the derived model using real-world data. The use of a laboratory experiment using one group of people as subjects to derive a model to predict the behavior of a different group of people in a real-world setting has been employed in such diverse areas as residential relocation choice [Lerman and Louviere, 1978 and Levin et al., 1981], consumer patronage [Louviere and Meyer, 1981], and transportation mode usage [Louviere and Kocur, 1979].

Our research is similar to research in accounting that has employed Brunswik's lens model as a conceptual framework. (See Libby and Lewis [1982] for a review of this research.) The lens model framework was originally suggested for accounting situations by the Committee on

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[1] See Jackson and Milliron [1986] for a review of this body of literature.

[2] Since 1963 the IRS has periodically selected approximately 50,000 individual tax returns for TCMP audit. Taxpayers selected are required to support virtually every item on the return. The results of these audits are used by the IRS to project the degree of compliance among taxpayers who file returns and to develop discriminant functions that are used to identify returns that should be audited. Summary statistics from these analyses have been published in U.S. Internal Revenue Service [1983], which provides compliance estimates for 1973–81, derived in part from TCMP data. Additionally, the TCMP division will provide researchers with tabulations of aggregate line item amounts from completed TCMP audits.

Accounting Valuation Bases [1972] and by Ashton [1974]. We depart from the lens model tradition in two respects, however. First, we did not presume that a linear model is the appropriate representation of human judgment. Our experiment in the first phase of the study was designed to discriminate among three plausible models of human judgment, two of which are nonlinear. We considered alternative models because they make different predictions regarding the effects of changes in the independent variables in the model. For example, if the model is linear, the effect on taxpayer compliance of a change in the level of any one variable is predicted to be *independent* of the levels of the other variables in the model. On the other hand, if the derived judgment model is nonlinear, the effect of a change in the level of any one variable is predicted to be *dependent* on the levels of one or more of the other variables in the model.

Second, we relied primarily upon qualitative tests that utilize the nature of the observed interactions in the judgment data to discriminate among the models. Such qualitative tests have proven effective in discriminating among alternative judgment models even when the difference among the correlation coefficients obtained for the competing models is quite small [Schepanski, 1983a]. Careful discrimination among the competing judgment models is desirable because the ultimate use for the derived judgment model from experiments such as ours is in applied prediction. Since the usefulness of the derived judgment model in applied prediction can be evaluated properly only in terms of the loss function of the potential user of the model [Demski and Feltham, 1972] and that loss function is unknown, the added predictive accuracy offered by the derived judgment model may be important.

Once the model that best accounted for the judgments of the tax professionals in our experiment was determined, we tested the external validity of the model by using it to predict actual taxpayer compliance in the IRS TCMP data base. Because of limitations in the availability of the TCMP data, our validation of the derived judgment model was only partial. In the context of the lens model framework, this second phase of the study is analogous to assessing the prediction achievement of the model [Libby, 1975]. Again, in contrast to lens model research, we evaluated the judgment model primarily on the basis of its ability to predict the interactions in the TCMP data and secondarily on the basis of its correlation with the TCMP data.

Our interest in the interactions is not limited to their use in discriminating among alternative judgment models and in assessing the external validity of the derived judgment model. The existence of interactions should be of practical interest to policy makers as well. For example, an interaction that would be of interest to policy makers is one in which rate structure and penalty interact such that taxpayer compliance is significantly greater under a moderately progressive tax rate structure than under a steeply progressive rate structure when penalties are low, but not significantly different under either rate structure when penalties are high. Such an interaction would suggest that significant increases in taxpayer compliance are more likely to be obtained by increasing (politically unpalatable) penalties when the tax rate structure is steeply progressive than when the tax rate structure is moderately progressive.

Independent Variables

Four independent variables were manipulated in the judgment experiment—

source of income, amount of income, the tax rate structure, and penalty for cheating. Since the second phase of this experiment was a test of the external validity of the derived model, the variables included were factors that could be validated using IRS TCMP data. Validation of two of the factors (the rate structure and the penalty for cheating) requires time-series data that were not available at the time of this study. Validation of the model using only the amount and source variables, however, was possible with one year's data.

There are a number of factors that could be validated using IRS TCMP data. For example, TCMP data include information on the taxpayer's age (over 65 or not), marital status, number of dependents, specific sources of income and deductions, etc.[3] All factors of interest could not be included because the time required of subjects would have been excessive. Those we selected (source of income, amount of income, penalty, and rate structure) have been included in a number of prior studies and have the potential to yield sufficient numbers of taxpayers in the TCMP data to validate our results.

Prior research led us to believe that these four factors are determinants of taxpayer compliance, though not the only determinants. Our expectation was that income from self-employment would be subject to lower compliance than income from salaries (see, for example, Groves [1958] and U.S. Internal Revenue Service [1983]). Likewise, Allingham and Sandmo [1972] demonstrate analytically that higher penalty rates should be associated with higher compliance levels. Other researchers have found, however, that the effectiveness of penalty is affected by the levels of the factors with which it is combined [Jackson and Jones, 1985; Witte and Woodbury, 1985; Schwartz and Orleans, 1967]. No unambiguous predictions could be made based on prior research with respect to the independent (main) effects of amount of income or the tax rate structure. Results from a variety of research methods seem to support the intuitively appealing notion that compliance will increase as the taxpayer's marginal tax rate falls [see Clotfelter, 1983 and Friedland et al., 1978], but it is difficult to disentangle the effects of income level, risk aversion, etc. in these studies. Even less clear results emerge from studies in which amount of income has been included as a factor, possibly because of interaction with source of income [Jackson and Milliron, 1986]. The present study offers the advantage of combining these four variables in a research design that permits an independent assessment of main effects and interactions.

Task

Subjects were presented with a series of cases describing hypothetical taxpayers in terms of the four factors discussed above. They were asked to judge the percent of true tax liability that would be reported by a "typical" taxpayer (not necessarily their own client) in each case. The Appendix contains a copy of the instructions, including five practice cases each subject completed before beginning the judgment task.

Experimental Design

Specific cases for evaluation by the

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[3] One factor that we considered including was probability of audit, a variable that has been included in a number of studies. However, an effort to validate results with TCMP data would likely have yielded a negative relationship between voluntary compliance and audit probability, assuming that the IRS audit rates accurately proxy the likelihood of detection. Clotfelter [1983, p. 368] refers to this problem as "simultaneity bias." For a further discussion, see Graetz and Wilde [1985, footnotes 6 and 14].

CPA/tax professionals were generated from a series of factorial subdesigns which differ from each other in the type of independent variable presented or in both the type and number of independent variables presented. Thus the experimental design consists of four factorial subdesigns in which one variable was presented, three in which two variables were presented, two in which three independent variables were presented, and one subdesign consisting of all four independent variables. The purpose of varying the information set size in this manner was to permit greater diagnostic power in testing alternative models of judgment behavior and to permit the estimation, for certain models, of the parameters indicative of the relative importance of different determinants of taxpayer compliance.

Three levels of each independent variable were employed. The levels are described in the instructions to the questionnaire (see Appendix). Amount of gross income was set at "$80,000," "$32,000," and "$12,000." The three levels of source of income were "mostly self-employment," "approximately equal salary and self-employment," and "mostly salary." Rate structure was either "steeply progressive" (pre-1981, top marginal rate 70 percent), "moderately progressive" (post-1980, top marginal rate 50 percent), or "flat" (tax equal to 20 percent of gross income). The penalty if caught cheating consisted of two parts—a percentage of the underpaid tax and interest on the underpaid tax. The three levels were "11 percent plus interest at 2.5 percent over the money market rate," "five percent plus interest at 1.5 percent over the money market rate," and "five percent plus interest at three percent less than the money market rate." These penalty levels are representative of those experienced by taxpayers during the period 1979–1983.[4] The levels of the independent variables were chosen to cover most of the naturally occurring range and to provide approximately equal spacing between them to facilitate subsequent testing of competing models. This choice was made subject to the constraint that a reasonably large number of cases exist in the TCMP file for the chosen levels for the amount of income and source of income variables.

To summarize, the experimental design consisted of four 3×1 factorial subdesigns—Amount Only, Source Only, Rate Structure Only, Penalty Only; three 3×3 factorial subdesigns—Amount×Source, Source×Penalty, Rate Structure×Penalty; two 3×3 factorial subdesigns in which three independent variables were presented—(Amount = Source)×Penalty, (Amount = Source)×Rate Structure; and one 3×3 factorial subdesign in which four independent variables were presented—(Amount = Source)×(Rate Structure = Penalty). Note that (Amount = Source) is a composite factor in which the $12,000 level of Amount was presented only with the "Mostly Self-Employment" level of Source, the $32,000 level of Amount was presented only with the "Mixed" level of Source, and the $80,000 level of Amount was presented only with the "Mostly Salary" level of Source. In a similar manner, the "Steeply Progressive," "Moderately Progressive," and "Flat" levels of Rate Structure were presented only with the corresponding

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[4] The penalty levels were set at the levels specified in IRC section 6653(a) for negligence (five percent of the underpayment plus, for years after 1982, 50 percent of the interest payable under section 6601) on the filing dates for returns in the three most recent TCMP files (4-15-77, 4-15-80, and 4-15-83). The interest rates reflect the relationship between IRS rates specified in section 6601 and approximate money market rates on the same dates. For example, on 4-15-80, the IRS rate was 12 percent, approximately three percent less than the money market rate at that time, and the negligence penalty was five percent.

"low," "medium," and "high" levels of Penalty for the composite factor (Rate Structure = Penalty). The complete experimental design is presented in Figure 1. This experimental design required subjects to judge 66 cases. To include all possible combinations of three levels of four variables in our experimental design would have required that 255 cases be employed ($1\times3^4+4\times3^3+6\times3^2+4\times3^1$). The selective use of composite factors made it possible to reduce the number of cases that participants were required to evaluate while still retaining the ability to estimate model parameters.

Subjects

Seventy-one CPAs specializing in taxation from two major public accounting firms participated in the study. The data of six subjects who omitted some cases were discarded. The subjects were from ten different cities in the midwest, south, and southwest. We specifically asked that all participants be involved in the preparation of individual returns and/or have substantial contact with individual clients. Of the 65 subjects, 11 had one to three years experience in tax work, 20 had four to six, 13 had seven to ten, and 21 had more than ten years experience. Subjects' responses were examined for differences across experience levels, and no systematic differences were found.

Administration

The 66 cases were printed in random order in a booklet along with instructions and five practice cases. Each subject received a different random ordering of the cases. Booklets were mailed to a member of the firm who agreed to coordinate their distribution and collection. Subjects estimated that they spent between 30 minutes and one hour completing the judgment task.

Reliability

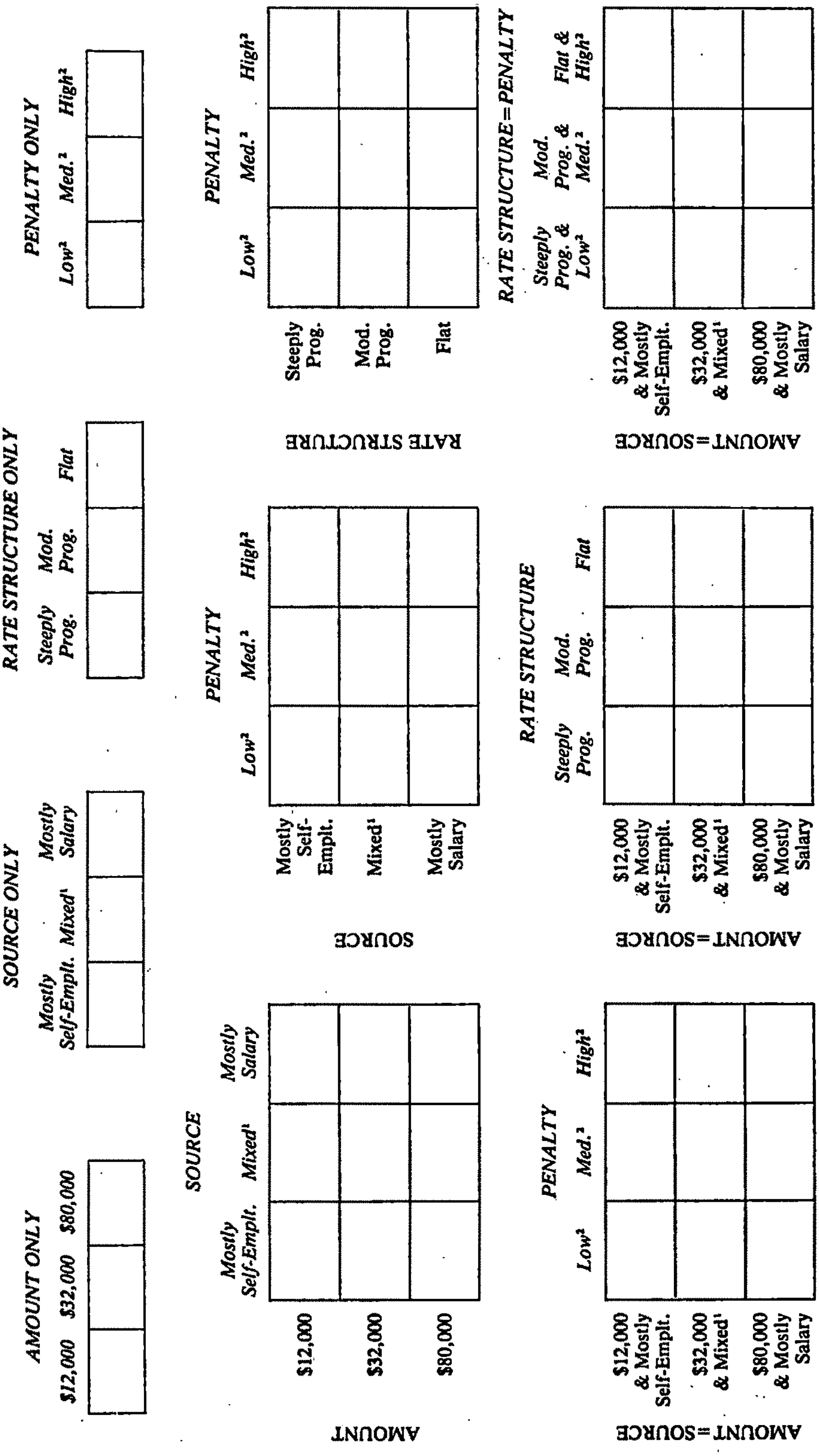
Two measures were used in this research to test the reliability of subjects' compliance ratings. The first was Kendall's coefficient of concordance, a measure of between-subject reliability of ratings [Siegel, 1956, p. 234]. The coefficient of concordance for the 65 subjects in the present sample was .602 (chi square 2544.06, degrees of freedom 65, $p<.0001$).

Standard errors of the mean judgments provide a second measure of reliability (sometimes referred to as consistency [Runkel and McGrath, 1972]). This concept of reliability has to do with the repeatability of order relationships between any two data points. Thus, for example, if one mean judgment fell within one standard error of another, any theoretical inferences that might be drawn from the ordinal relationship of these data points is weaker than would be the case if they exceeded one standard error. In the present study, the standard errors of the mean judgments ranged from a low of .50 to a high of 2.04. The mean and median standard errors were 1.27 and 1.25, respectively. Thus the typical standard error amounted to only slightly more than one point of the total 101-point response scale (zero to 100 percent). These standard errors appear sufficiently small to suggest a generally high degree of reliability in drawing inferences regarding ordinal relationships in the data. As will be shown later in the paper, this conclusion was confirmed for the specific ordinal relationships that were examined in the present research.

Models

While the number of potential model candidates is very large, prior research in human information processing, as well as considerations of simplicity of representation, suggest the following as plau-

FIGURE 1
EXPERIMENTAL DESIGN



[1] Mixed = Approximately equal salary and self-employment
[2] Low = 5 percent plus interest at 3 percent less than the money market rate
Med. = 5 percent plus interest at 1.5 percent over the money market rate
High = 11 percent plus interest at 2.5 percent over the money market rate

sible ones to consider for this task. The first is the linear (main-effects additive) model, which may be written,

$$\Psi_{ijkl} = w_0 s_0 + w_S s_{Si} + w_A s_{Aj} + w_P s_{Pk} + w_R s_{Rl}, \tag{1}$$

where w_0 and s_0 refer to the absolute weight and subjective value, respectively, of a postulated initial impression prior to receiving information on the manipulated variables; the remaining w's refer to the absolute weights reflecting the subjective diagnosticity of the variable; the remaining s's refer to the participants' subjective assessment of each level of the independent variables; and Ψ is the overall assessment of taxpayer compliance. The subscripts refer to the initial impression (0) and to the independent variables source of income (S), amount of income (A), penalty (P), and rate structure (R).

The linear model warrants consideration because of its simplicity and because many studies in the lens model paradigm have been interpreted as supportive of the model (for a review, see Libby and Lewis [1982]). The linear model predicts that the effect upon judged compliance of a change in the level of any given independent variable will be the same regardless of the number and/or type of other independent variables employed in the evaluative process. If a graphical plot of these predictions were made, the curves would all be parallel.

The second model is the constant-weight averaging model,

$$\Psi_{ijkl} = w_0^* s_0 + w_S^* s_{Si} + w_A^* s_{Aj} + w_P^* s_{Pk} + w_R^* s_{Rl}, \tag{2}$$

where the $w^*(=w/\Sigma w)$ parameters refer to the *relative* weights reflecting the subjective importance of the variables in the participants' evaluation. Prior research in impression formation [Anderson, 1974] and personnel selection [Norman, 1976b] has been interpreted as supportive of this model.

In those experimental subdesigns in which both the number and type of independent variables are constant, the constant-weight averaging model is indistinguishable from the linear model. Thus a graphical plot of the model's predictions in these subdesigns would also exhibit parallelism. For example, the model predicts that parallelism would be observed in each of the six subdesigns that contain more than one independent variable (see Figure 1). The parallelism prediction can be tested by performing an analysis-of-variance of the data from such subdesigns. No significant interactions should be observed.

However, this model also predicts that the effect upon judged compliance of a change in the level of an independent variable will be proportional to that variable's effective weight, $w^*(=w/\Sigma w)$. As the denominator of this expression indicates, a variable's effective weight depends on the number of other independent variables with which it is combined, as well as their absolute weight. Thus the effect upon judged compliance of a change in the level of a given variable is predicted to vary inversely with (rather than be independent of, as in the linear model) the number of independent variables employed in the evaluative process. For example, the effect on compliance of a change in the level of a variable (e.g., Penalty) is predicted to be greater when it is presented alone (i.e., in the Penalty Only subdesign) than when it is combined with other independent variables (e.g., in the Rate Structure × Penalty subdesign—see Figure 1—because $w_P/(w_0+w_P) > w_P/(w_0+w_P+w_R)$). In cases where the number of variables employed in the evaluative process is constant, the effect upon judged compliance of a change in the level of a given variable is predicted to vary inversely with the absolute weight (w) of the *other* independent variables (rather than be independent of the absolute weights of the other independent variables, as in the linear model). For example, the effect on compliance of a change in the level of a variable (e.g., penalty) is predicted to differ when it is combined with one variable (e.g., source in the Source × Penalty subdesign) than when it is combined with another variable (e.g., rate structure in the Rate Structure × Penalty subdesign—because $w_P/(w_0+w_P+w_S) \neq w_P/(w_0+w_P+w_R)$ if $w_S \neq w_R$). A graphical plot of these predictions, therefore, would exhibit a systematic pattern of nonparallelism, whereas the linear model predicts that parallelism will be observed.

A third possibility is the range model,

$$\begin{aligned}\Psi_{ijkl} = {} & w_0^* s_0 + w_S^* s_{Si} + w_A^* s_{Aj} + \omega_P^* s_{Pk} \\ & + w_R^* s_{Rl} + \omega \{ Max(s_{Si}, s_{Aj}, s_{Pk}, s_{Rl}) \\ & - Min(s_{Si}, s_{Aj}, s_{Pk}, s_{Rl}) \}. \qquad (3)\end{aligned}$$

The judgment formation process is represented as a constant-weight averaging model (equation 2), modified by a within-set range term (in braces) where ω is an empirical constant reflecting the magnitude of the within- set range effect.[5] This model has received empirical support in a variety of psychophysical and social judgment tasks [Birnbaum et al., 1971; Birnbaum, 1972].

The range model, unlike the previous models, is a configural-weight model that represents the judge as modifying his weighting of information depending upon the rank of each independent variable's scale value (s) in the set of variables used in the judgment process. The predictions of this model are similar to those of equation (2) except in those subdesigns where both the number and type of independent variables are fixed. If ω is nonzero, the model predicts that the effect on judged compliance of a change in the level of an independent variable will *not* be independent of the levels of other independent variables in such designs. Thus a graphical plot of the model's predictions in these designs would exhibit nonparallelism, which implies that an ANOVA of the data should produce statistically significant interactions.

The theoretical approach to modeling used in this research assumes that individual decision-making behavior can be represented by three functional relationships. The first is the psychophysical function (H) which relates the subjective values of the levels of the independent variables (the s's in equations (1), (2), and (3)) to their corresponding objective values presented in the experiment. That is, $s_m = H(X_m)$, where X is the objective value of the mth independent variable. In the present experiment, $m=4$. These subjective values are sometimes referred to as "utilities" or "part-worths." They do not need to be known to test the model but can be solved for after the model has been evaluated. The second is the composition rule (I) which describes how the subjective values are assimilated to yield an overall assessment of taxpayer compliance. That is, $\Psi = I(s_1, s_2, \ldots, s_m)$, where I is the model that describes how the subjective values are assimilated in reaching a subjective assessment of taxpayer compliance (Ψ). Equations (1), (2), and (3) are three alternative hypotheses for I. The third is the

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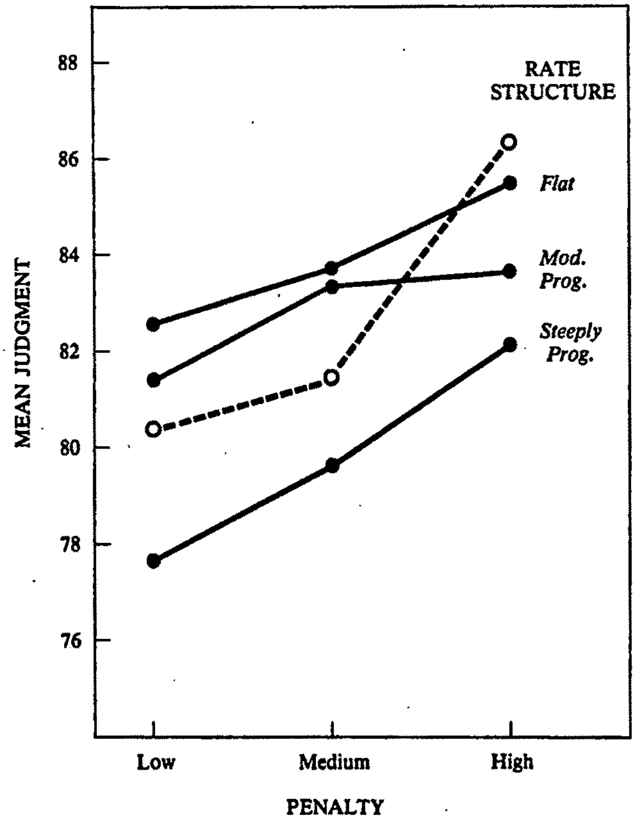
[5] Previous research [Schepanski, 1983a] found that this model yielded predictions that were very similar to the geometric averaging model (a type of multiplicative composition rule with exponential weights summing to one) in the context of the design of that study. Since the design of the present research was guided by considerations of feasibility in obtaining an external validity test, a serious test between these two models could not be performed. Accordingly, the range model (rather than the geometric averaging model) was selected for inclusion in the present study because parameter estimation is far less difficult and costly.

FIGURE 2

MEAN JUDGMENTS OF COMPLIANCE AS A FUNCTION OF PENALTY WITH A SEPARATE CURVE FOR EACH LEVEL OF RATE STRUCTURE



response function, J, that transforms Ψ to R, the observed rating. That is, $R=J(\Psi)$, where J could be any monotone function. In testing equations (2) and (3), J is assumed to be linear, i.e., $R=a\Psi+b$, where a and b are constants that define the unit and zero point of the response scale. As will be shown later, equation (1) can be tested assuming J is only monotone. Thus individual decision-making behavior is viewed as the composition of all three functional relations, viz., $R=J(I(H(X)))$ [Schepanski, 1983b].

RESULTS

Model Tests

Figure 2 presents mean judgments for the Rate Structure by Penalty subdesign (solid curves, solid circles) as well as the single-variable subdesign for Penalty (dashed curve, open circles). Note that the dashed curve crosses the solid curve at the "moderately progressive" level of Rate Structure (the differences between the open and solid circles exceed one standard error at the "medium" and "high" levels of Penalty). Such crossovers are ordinally inconsistent with equation (1).[6] Similar crossovers were present when the single-variable subdesign for Source (Rate Structure) was compared to subdesigns containing two or more independent variables containing Source (Rate Structure), and were also present when pairs of two-variable subdesigns which share one independent variable in common were compared. These aggregate results also characterized the individual-subject data for the majority of subjects. While crossover interactions of this nature are ordinally inconsistent with equation (1), they remain consistent with equations (2) and (3). This follows from the fact that equations (2) and (3) predict that the effect on judged compliance of a change in Penalty will be proportional to $w_P/(w_0+w_P)$ when it is presented alone, and to $w_P/(w_0+w_P+w_R)$ when it is presented together with Rate Structure. Thus the steeper slope of the dashed curve over the solid curves in Figure 2 is consistent with these models.

A repeated-measures analysis-of-variance was performed for each of the ten subdesigns. Results are summarized in Table 1. Main effects were statistically significant ($p<.05$) in all subdesigns except for the single-variable subdesign for Amount. The main effects in all subdesigns were ordered as follows. For Amount, mean judged compliance was greater at the "high" level than at the "low" level; for Source, mean judged compliance was greater when Source was "mostly self-employment" than when Source was "mostly cash"; for Rate Structure, mean judged compliance was greater when Rate Structure was "flat" than when it was "steeply progressive"; and for Penalty, mean judged compliance was greater at the "high" level than at the "low" Penalty level. Four of six possible interactions also achieved statistical significance ($p<.05$). The form of this interaction is illustrated in Figure 3, which presents mean judgments for the Penalty by Source subdesign. This subdesign, when analyzed independently of the other subdesigns, is fixed in terms of the number and type of independent variables. Note that the curves converge to the right. That is, the effect on judged compliance of changes in Penalty is greater when Source is "mostly self-employment" than when it is "mostly salary." All of the remaining significant interactions, as well as one of the two nonsignificant ones, displayed a similar pattern of convergence.[7] Interactions such as these are inconsistent with equations (1) and (2) but can be accounted for by equation (3) with only one additional parameter over the number required by equation (2). Among the models tested, therefore, the range model (equation 3) provides the best account of these data.

A mean response to each of the 66 experimental cases was obtained by computing an average of the responses given by each of the 65 subjects to reduce the random error component presumed to exist in subjects' responses. The param-

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[6] To see why this is the case compare, first, the mean responses to the two trials [Penalty="medium"] and [Rate Structure="moderately progressive"; Penalty="medium"]. The latter differs from the former by the addition of a "moderately progressive" level of Rate Structure. The fact that the mean response to the latter trial exceeded that of the former implies that s_{R2}, the subjective value of the "moderately progressive" level of Rate Structure, must be >0 if equation (1) is valid. That is,

$$(w_0 s_0 + w_P s_{P2} + w_R s_{R2}) > (w_0 s_0 + w_P s_{P2})$$
$$\Rightarrow w_R s_{R2} > 0 \Rightarrow s_{R2} > 0$$

since w_R cannot be zero or negative. Second, compare the responses to the two trials [Penalty="high"] and [Rate Structure="moderately progressive"; Penalty="high"]. As before, the latter trial differs from the former by the addition of the "moderately progressive" level of Rate Structure. According to equation (1), the lower mean response to the later trial implies $s_{R2}<0$, which contradicts the earlier conclusion that it was >0.

[7] Note that the solid curves in Figure 2 converge to the right.

TABLE 1
ANOVAS OF MEAN RESPONSES

Subdesign	*Sources of Sums of Squares*	*Degrees of Freedom*	*Sums of Squares*	*F-Value*	*Prob.*
Amount Only	Amount	2	91.73	.87	.4200
Source Only	Source	2	13,613.36	138.28	.0001
Rate Structure Only	Rate Structure	2	1,315.39	15.02	.0001
Penalty Only	Penalty	2	1,377.35	13.37	.0001
Amount × Source	Amount	2	662.04	5.45	.0054
	Source	2	43,884.90	193.45	.0001
	Amount × Source	4	1,587.60	15.45	.0001
Source × Penalty	Source	2	34,858.01	161.72	.0001
	Penalty	2	1,620.93	19.07	.0001
	Source × Penalty	4	303.98	2.91	.0223
Rate Structure × Penalty	Rate Structure	2	1,728.22	11.43	.0001
	Penalty	2	964.80	7.23	.0011
	Rate Structure × Penalty	4	100.22	.73	.5732
(Amount = Source)* × Penalty	(Amount = Source)	2	43,271.15	115.60	.0001
	Rate Structure	2	1,202.29	17.54	.0001
	(Amount = Source) × Penalty	4	223.89	3.07	.0170
(Amount = Source)* × Rate Structure	(Amount = Source)	2	44,287.60	121.59	.0001
	Rate Structure	2	1,284.65	18.55	.0001
	(Amount = Source) × Rate Structure	4	85.23	.96	.4277
(Amount = Source)* × (Rate Structure = Penalty)*	(Amount = Source)	2	41,848.15	128.33	.0001
	(Rate Structure = Penalty)	2	3,787.02	33.86	.0001
	(Amount = Source) × (Rate Structure = Penalty)	4	322.15	3.87	.0045

* The "$12,000" level of Amount was paired with "Mostly Self-Employment" (i.e., low with low); the "$32,000" level of Amount was paired with "Mixed" (i.e., medium with medium); the "$80,000" level of Amount was paired with "Mostly Salary" (i.e., high with high). A similar pairing was made with Rate Structure and Penalty in the (Amount = Source) × (Rate Structure = Penalty) subdesign.

eters of the range model were estimated from the mean data using a dummy-variable regression procedure [Chandler, 1969] that employed a least-squares criterion. The relative weights (indices of the relative importance of the variables) estimated in accord with the model were as follows: Source, .24; Penalty, .08; Rate Structure, .06; and Amount, .03. It can be shown that coefficients calculated in this way satisfy the assumptions of a ratio scale [Luce, 1981] and that they are independent of the subjective scale value of the levels of the independent variables [Norman, 1976a]. In general, therefore, the taxpayer's source of income can be interpreted as three times as important as the next most heavily weighted variable (Penalty).[8] However, the relative weights

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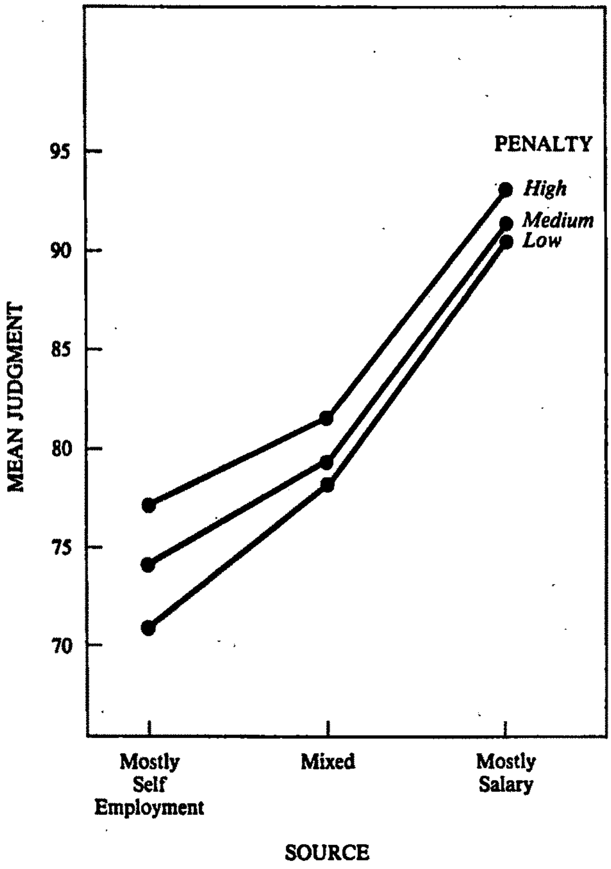
[8] Since these weights were estimated with error-filled data, they may not be significantly different from each other. If this hypothesis is true, it implies that the obtained ranking of relative importance (Source, Penalty, Rate Structure, Amount) is not more likely than any of the other 23 possible rankings. The following proce-

FIGURE 3

MEAN JUDGMENTS OF COMPLIANCE AS A FUNCTION OF SOURCE WITH A SEPARATE CURVE FOR EACH LEVEL OF PENALTY



will vary from case to case because the range model adjusts the weights to take into account the configural range term, ω, which was estimated to be .03.

The range model is a configural-weight model in the sense that the relative weight (importance) of a variable is predicted to vary with the *rank* of its subjective scale value (i.e., the s's in equation (3), which are a function of the levels of the variables) in the set of variables used by the subject in evaluating each individual case, where each case consists of one

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dure was employed to test this hypothesis. Weights were estimated for each subject in accord with equation (3). The subjective scale values for the levels of the independent variables were assumed to be the same for all subjects, but the omega parameter (ω) and the scale value of the initial impression (s_0) was allowed to vary across subjects along with the weights. The relative weights for 27 subjects exhibited the same rank ordering as that obtained with the aggregate data, whereas only about two or three subjects would be expected to exhibit this rank ordering if the hypothesis of "no difference" among the relative weights is true ($p<.0001$, binomial test). This result shows that the ranking of the weights in the aggregate data cannot be attributed to random error, even though some of the weights may seem to be close to one another.

level of each of the four variables. For example, suppose for one of these cases the subjective scale values of the four variables were ranked, from lowest to highest, as follows: Penalty, Source, Rate Structure, and Amount. According to the range model, the lowest-valued variable loses effective weight (importance) by ω, which in turn is gained by the highest-valued variable. (If ω were negative, the weight switch would be the reverse.) Thus the relative weights for this case now become, from highest to lowest, as follows: Source, .24; Amount, .06 (.03+.03); Rate Structure, .06; and Penalty, .05 (.08−.03). Note that the relative importance of Amount increases from fourth to second among the four variables.

In general, therefore, the data are consistent with a theory (model) that predicts that the effect of a change in the level of any given variable is more likely to have its greatest effect on taxpayer compliance when other variables are at low levels than at high levels.[9] For example, the theory predicts that the effect of a change in Penalty is more likely to have its greatest effect on taxpayer compliance when amount of income is low, rate structure is steeply progressive, and source of income is self-employment, and is likely to have its least effect when income is high, rate of structure is flat, and source of income is mostly salary. The predicted effect of changes in the levels of other independent variables follows analogously.

External Validity Test

As noted earlier, the second phase of this study was to test the external validity of the model selected in the first phase as best representing the judgments of tax-preparer professionals. Ideally, such a test would employ "true" compliance levels in the general population. In spite of some shortcomings,[10] the TCMP data appear to be the best available estimates of non-compliance among taxpayers who file returns.

Since the variables Penalty and Rate Structure required time-series data that were not available at the time of this study, the test of external validity was confined to the remaining two variables, Amount and Source. Returns in the TCMP file were selected on the basis of a factorial combination of three levels of total positive income (as corrected by the TCMP audit) crossed with three income source categories. Total positive income (TPI) is defined as the sum of all positive income items on the return. Additionally, returns selected had no partnership income, estate and trust income, or small business corporation income. The three levels of total positive income were $10,000–15,000 ("low"), $30,000–35,000 ("medium"), and $50,000–100,000 ("high"). The three income source categories were "mostly salary" (salary equal to at least 80 percent of TPI), "mixed" (salary between 35 and 65 percent of TPI), and "mostly self-employment" (Schedule C gross income equal to at least 80 percent TPI).

The IRS will not provide researchers with individual taxpayer data from recent TCMP files. It will provide aggregate tabular data, and in some cases such

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[9] The terms "low" and "high" are used here in a generic sense to refer to those two of the three levels of each independent variable that yield the lower and higher respective ratings of compliance. Thus the "low" levels for Source, Amount, Penalty, and Rate Structure are respectively, "mostly self-employment," "$12,000," "low," and "steeply progressive." The corresponding "high" levels are "mostly salary," "$80,000," "high," and "flat."

[10] Clearly, the TCMP data are flawed estimates of the true levels of compliance among taxpayers who file returns. In particular, the IRS acknowledges that TCMP audits are much better at detecting overstated deductions than understated income. For an excellent discussion of this and other problems with the TCMP data, see U.S. Internal Revenue Service [1983, pp. 49-68 and 133-164].

TABLE 2

TCMP MEAN COMPLIANCE RATES AND MODEL PREDICTIONS

	Source*		
Amount	*Mostly Self-Employment*	*Mixed*	*Mostly Salary*
High $50–100,000	.8005 (.7429) $n=938$	.8821 (.8081) $n=117$	.9563 (.9364) $n=1796$
Medium $30–35,000	.7677 (.7492) $n=147$	.8162 (.8143) $n=135$	.9631 (.9369) $n=931$
Low $10–15,000	.6839 (.7065) $n=493$	.7285 (.7884) $n=153$	.9292 (.9337) $n=2004$

* Mostly self-employment: Schedule C gross income ≥80 percent total positive income (TPI).
Mixed: Salary between 35 and 65 percent TPI.
Mostly Salary: Salary ≥80 percent TPI.

Compliance rates contained in this table were provided by the IRS TCMP Division from 1979 returns filed in 1980.

Predictions were generated in accordance with the range model (eq. (3)) and are shown in parentheses under TCMP compliance rates.

as this study, aggregate data calculated to researchers' specifications. For each of the nine categories of returns described above, the IRS provided a calculation of average compliance, defined as tax reported divided by tax per examination. Further, these averages were appropriately weighted by the IRS to reflect sampling rates for the population, thereby providing an estimated average compliance level for the entire population of similar taxpayers. These data are based on information in the IRS 1980 TCMP file and are shown in Table 2.

Numerical predictions of the external compliance data were generated as follows. The parameters w_P^* and w_R^* in equation (3) were set equal to zero, resulting in the following reduced, two-factor model:

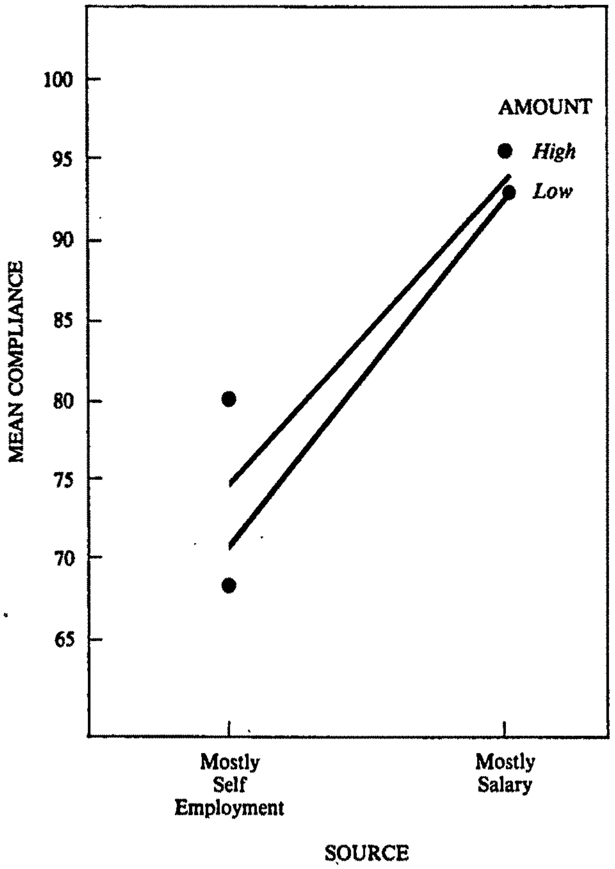
$$\Psi_{ij} = w_0^* s_0 + w_S^* s_{Si} + w_A^* s_{Aj} + \omega\{Max(s_{Si}, s_{Aj}) - Min(s_{Si}, s_{Aj})\} \quad (4)$$

Predictions of the mean TCMP data were generated from equation (4) using the parameter values previously estimated from the experimental data.

Figure 4 presents the predictions of the range model (solid lines) and the IRS data (solid points) for two levels of Amount ("low" and "high") and two levels of Source ("mostly self-employment" and "mostly salary"). Two levels were used to simplify the presentation since judgments at the "medium" level of Amount were found to be not significantly different from those at the "high" level, and judgments at the "low" level when Source was "mixed" (Tukey's HSD test, $p<.05$). This figure reveals a convergent interaction between Amount and Source. That is, the effect on compliance of changes in Amount is greater when the source is "mostly self-employment" than when it is "mostly salary." Note that the range model correctly predicted this interaction.

FIGURE 4

MEAN TCMP COMPLIANCE RATES AS A FUNCTION OF TWO LEVELS OF SOURCE WITH A SEPARATE CURVE FOR TWO LEVELS OF AMOUNT



The solid points represent the TCMP empirical means. The solid lines represent predictions, based on the range model equation (3), of the experimental judgment data for the Amount × Source subdesign.

As a secondary test of the external validity of the range model (equation (3)),we correlated the predictions of the model and the TCMP data. The resulting Pearson product-moment correlation was .92. To provide a basis for comparison, corresponding correlations for equations (2) and (1), after being reduced to the two-factor form, were also computed. Consistent with prior research [Schepanski, 1983a], the differences between the correlations were not large. The correlations between equation (2) and equation (1) and the TCMP data were .91 and .90.

Discussion

Our feasibility study has demonstrated

that the judgment modeling approach has the potential for offering a flexible and relatively inexpensive means of predicting the effects on taxpayer compliance of changes in various provisions of the law. The study is limited in that only four variables were considered and validation of the model using all four of the variables was not possible. The results, though preliminary, suggest that this approach may offer policy makers a much less expensive and more timely means of predicting the effect of proposed changes in the law than large-scale taxpayer surveys. The approach also should be useful for studying the effect on tax compliance of a variety of factors not considered in the present study or of additional levels of factors that were considered.

A second contribution of the study is that it has demonstrated the critical importance of source of income relative to some other commonly studied variables in determining compliance. Evidently, taxpayers are much more likely not to report income they feel cannot be traced than income reported by W-2 or information return, and in this study this effect far outweighed the effects of penalty size, amount of income, or rate structure. One implication of this result is that significant improvements in compliance might be brought about by moving toward a more "cashless" society or by requiring broader use of information returns. Future study might contrast the effects on compliance of various reporting proposals.

Finally, we believe that this type of study, in which judgments of tax preparers were partially validated by external data, should provide greater confidence in results that cannot be similarly validated. For example, researchers might use tax professionals to judge the effect on compliance of factors, such as social sanctions, that cannot be validated using TCMP data.

APPENDIX

Instructions

In this study we seek to draw on your knowledge and experience as a tax expert to assess the extent to which a "typical" taxpayer (not necessarily your client), would report his true income tax liability. A recent cover article in *Time* magazine refers to tax evasion as "not just a sickness but an epidemic." The article states that a "large and growing number of Americans . . . will decide to cheat" [*Time*, March 28, 1983]. In a similar article, *Business Week* [April 16, 1984] states that "Americans—pushed into higher tax brackets by inflation, confused by extraordinarily complicated tax laws, and convinced that the tax code is unfair—have become a nation of tax evaders."

A number of variables are thought to be important in determining the extent to which taxpayers report their true tax liability. On the following pages, you will be presented with a series of cases for which you are asked to judge the percent of true tax liability that a "typical" taxpayer (not necessarily your client) would report under selected combinations of these variables, which are described below:

Amount of true gross income

Gross income is defined for our purposes as gross receipts from salary, self-employment, interest, dividends, etc. We assume three levels of gross income:

$80,000
$32,000
$12,000

Source of gross income (italic description is presented in questionnaire)

The source of gross income may be

Mostly self-employment business receipts (at least 80% from Schedule C)

Approximately *equal salary and self-employment* receipts (approximately 40% from salary and 40% from self-employment)

Mostly salary (at least 80%)

Rate structure (italic description is presented in questionnaire)

The tax rate structure may be

Steeply progressive (pre-1981, top marginal rate = 70%)

Moderately progressive (post-1980, top marginal rate = 50%)

Flat (tax = 20% of gross income)

Penalty if caught cheating

The penalty consists of two parts—a percentage of the underpaid tax liability and interest on the underpaid tax liability. We assume three levels of penalty:

Penalty = 11% + interest @ 2.5% more than the money market (abbreviated in questionnaire as 11% + interest @ 2.5% more than $ market rate)

Penalty = 5% + interest @ 1.5% more than the money market rate (abbreviated in questionnaire as: 5% + interest @ 1.5% more than $ market rate)

Penalty = 5% + interest @ 3% less than the money market rate (abbreviated in questionnaire as: 5% + interest @ 3% less than $ market rate)

Below are five practice cases. Note that not all of the variables described above are represented in each case. This is intentional, so please respond with your best judgment of the percent of true tax liability reported based on the available information in each case. As you think about your judgments for the practice cases you may find it helpful to know that an article in the *Tax Adviser* several years ago (October 1978) reported that *on average* some classes of taxpayers voluntarily report and pay less than *57 percent* of their actual tax liability while for some other classes the *average* is close to *95 percent.*

1. AMOUNT OF TRUE GROSS INCOME: $32,000
   SOURCE OF GROSS INCOME: Equal salary and self employment
   PENALTY: 5% + interest @ 1.5% more than $ market rate

% true tax liability reported ____________ %

2. AMOUNT OF TRUE GROSS INCOME: $80,000
SOURCE OF GROSS INCOME: Mostly salary
RATE STRUCTURE: Flat
PENALTY: 11% + interest @ 2.5% more than $ market rate
% true tax liability reported ____________ %

3. SOURCE OF GROSS INCOME: Equal salary and self-employment
% true tax liability reported ____________ %

4. AMOUNT OF TRUE GROSS INCOME: $12,000
SOURCE OF GROSS INCOME: Mostly self-employment
RATE STRUCTURE: Steeply progressive
PENALTY: 5% + interest @ 3% less than $ market rate
% true tax liability reported ____________ %

5. SOURCE OF GROSS INCOME: Mostly self-employment
PENALTY: 11% + interest @ 2.5% more than $ market rate
% true tax liability reported ____________ %

Now complete the remaining cases in the order presented, taking care not to skip any as you proceed. No two cases are exactly alike; consequently, you should try to discriminate among the cases to the greatest extent possible and appropriate in your judgment. Do not, however, attempt to "keep track" of previous responses or perform numerical calculations. Treat each case independently as you proceed through the cases at a comfortable pace recording your best judgment in each instance.

Thank you for your help.

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An Examination of the Market Reactions Associated with SFAS No. 8 and SFAS No. 52

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ABSTRACT: Previous market-based research has generally failed to detect significantly negative market price reaction to the issuance of SFAS No. 8. Using standardized abnormal returns, this study re-examines the issue. Reaction to events culminating in the issuance of SFAS No. 52 is also studied. Finally, since the accounting method used prior to SFAS No. 8 may be related to the costs imposed by SFAS No. 8, the method is determined and its effect on the observed market reactions is investigated. Our results indicate an overall negative reaction to SFAS No. 8, with a positive reaction to SFAS No. 52. In addition, the pre-SFAS No. 8 method of accounting for foreign currency translation is found to be related to the market reactions to SFAS No. 8 and SFAS No. 52 in mixed and unpredictable ways.

THIS study has three purposes. One purpose is to re-examine the market reactions associated with the issuance of SFAS No. 8 using a more powerful test. A second is to determine the market reactions to specific events in the promulgation process leading up to SFAS No. 52. Finally, a third purpose is to assess the extent to which the market price reactions to these events are affected by the pre-SFAS No. 8 method of accounting for foreign currency translation.

Our re-examination of the market reactions to SFAS No. 8 is motivated by the lack of previous evidence demonstrating a significant negative market reaction. Ziebart [1985] demonstrates that when the market reaction is fairly weak, the use of standardized abnormal returns to control for the level of noise in the market model will enhance the ability to find a significant reaction. Accordingly, this study employs standardized cumulative abnormal returns to control for the reliability of the beta estimate.

The second purpose is motivated by the lack of research evidence regarding the effect, if any, that the change in foreign exchange reporting requirements due to the issuance of SFAS No. 52 had on the market. The promulgation

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process leading to SFAS No. 52 comprised a number of events spread over a fairly long period of time. Given the effect that SFAS No. 8 had on earnings variability and its impetus for costly hedging activities by management, the promulgation events indicated some activities that were seemingly favorable and others that were unfavorable to the probability of a possible change in SFAS No. 8. Assessment of the market reactions to these events may provide insight into the market's perception of the relative importance each event may play in the promulgation process. This may also assist in determining the appropriate promulgation event on which to focus when trying to test the market's reaction to changes in accounting policy by the FASB.

The third purpose of this paper concerns the extent to which the pre-SFAS No. 8 method of accounting affects the associated market reactions regarding SFAS No. 8 and SFAS No. 52. We expect that the reaction to SFAS No. 8 and to SFAS No. 52 for an individual firm should be dependent, to some extent, upon the method actually used by the firm prior to SFAS No. 8. Given contracting arrangements made prior to SFAS No. 8 that were based on the pre-SFAS No. 8 accounting method in use at that time, the change in reporting requirements due to SFAS No. 8 and SFAS No. 52 may differentially affect subsequent contracting costs across firms. Controlling for the pre-SFAS No. 8 method of accounting should enhance the power of this study to find significant market reactions. Firms that were using a method consistent with SFAS No. 8 prior to its issuance are expected to have a minimal, if any, market reaction when SFAS No. 8 was issued. Alternatively, most of the negative market reactions to SFAS No. 8 should be associated with firms that were using a pre-SFAS No. 8 method not acceptable under SFAS No. 8. Likewise, we expect that the change to SFAS No. 52 results in stronger positive market reactions for those firms that were using a method acceptable under SFAS No. 52 prior to SFAS No. 8.

SFAS No. 8 required many multinational corporations (MNCs) to include gains or losses on foreign currency translation in their reported income, leading to increased variation in income. To overcome this adverse effect on income, some corporations undertook costly hedging activities. Thus, we expect an overall negative market reaction regarding the adoption of SFAS No. 8.

Through the issuance of SFAS No. 52 in 1981, the Financial Accounting Standards Board revised the accounting practice for foreign currency translation and eliminated the pressure on MNCs to hedge their gains or losses due to changes in exchange rates. This change to SFAS No. 52 and the favorable events of the promulgation process leading up to its adoption should be associated with an overall positive market reaction if the market perceived that the change in accounting practice for foreign currency translation would bring a reduction in costly hedging practices of MNCs.

According to the research conducted by Business International Corporation [1982], the foreign exchange risk management practices of MNCs were significantly changed under SFAS No. 52 in comparison to the practices under SFAS No. 8. The evidence indicates that most MNCs reduced their forward exchange contracts. Accordingly, we expect a positive market reaction to SFAS No. 52 if we assume the market perceived its favorable impact on the foreign exchange practices of MNCs.

The time period leading up to the adoption of SFAS No. 52 encompassed a number of events by the Financial Accounting Standards Board which exemplify the promulgation process involved when an accounting standard is changed. From December 1974 through December 1981, the FASB (1) issued an exposure draft of SFAS No. 8, (2) issued SFAS No. 8, (3) voted not to reconsider the issue, (4) expressed interest in research regarding foreign currency translation methods, (5) announced a program of sponsored research on the subject, (6) proposed a change in SFAS No. 8, (7) solicited comments on the proposed change, (8) announced the results of its research, (9) voted to reconsider SFAS No. 8, (10) issued an exposure draft of SFAS No. 52, (11) revised the exposure draft, and finally, (12) issued SFAS No. 52. An analysis of the market reactions to each of these events in the promulgation process should allow assessment of its perceived importance by the financial market.

In the next section, a history of the events investigated as well as a summary of previous research regarding the impact of SFAS No. 8 are provided. The second section contains a description of the sample firms and their foreign currency translation methods prior to SFAS No. 8. Also included in the section is a description of the method for computing abnormal returns. In the third section, a description of the analyses and results is provided. The last section contains a brief summary of the findings and their implications.

HISTORY OF EVENTS LEADING TO SFAS NO. 52 AND THE EXPECTED MARKET REACTIONS

From the issuance of an exposure draft of SFAS No. 8 in December 1974 through the issuance of an exposure draft of SFAS No. 52 in 1980, the FASB provided mixed signals regarding its favored method of reporting foreign exchange translation. SFAS No. 8 was issued in 1975 to alleviate the problems associated with the various methods of foreign currency translation previously employed. It allowed only the temporal method to be used and required translation gains and losses to be recognized immediately in the income statement. The following events are believed to have a potential effect on the value of firms with substantial foreign currency translations. Each reflects a change in mandated accounting method or a change in the probability of such a mandated change [Leftwich, 1981].

SFAS No. 8 developed strong opposition in the financial community. For example, Massaro [1978] surveyed 117 corporate executives familiar with SFAS No. 8 (after two years of experience with it) and found 60 executives favoring repeal with 24 executives favoring substantial modification or amendment. The opposition was due to the fact that it made income figures highly vulnerable to changes in foreign exchange rates.

Many multinational corporations undertook costly hedging activities to offset potential "paper" profits or losses that resulted from the foreign currency translation. Several researchers have examined the effect of SFAS No. 8 on the exchange risk management activities of MNCs and found evidence that it caused management of MNCs to overemphasize reported earnings. Using various research approaches, Evans, Folks, and Jilling [1978]; Shank, Dillard, and Murdock [1979]; Morsicato [1980]; and Wilner [1982] found evidence that SFAS No. 8 adversely affected the management of MNCs.

Given this documented effect on management behavior, one would expect to find significant negative market reactions to the issuance of SFAS No. 8, yet no previous market-based studies have found significant evidence of a negative market reaction. Dukes [1978] found no significant difference between returns of MNCs and returns of other domestic firms during three periods which included the issuance of SFAS No. 8. Makin [1978] found a significant effect but only when the sample was based on MNCs for which the effect on earnings was extremely large. Shank, Dillard, and Murdock [1979] found that all MNCs were negatively affected to some extent but a comparison to unaffected firms did not reveal a significant difference.

On April 29, 1976, the FASB announced that it had voted not to reconsider SFAS No. 8. This action should have reinforced the perceived permanence of SFAS No. 8 and its impetus for foreign exchange hedging activities. Given real costs to hedge against "paper" losses, one would expect a negative market reaction since it was apparent that the hedging practices would continue.

A year later (April 19, 1977), the *Wall Street Journal* carried a story announcing the FASB's interest in research regarding foreign currency translation methods. To some extent, this was an informal indication that the FASB might consider modifications of SFAS No. 8. A positive reaction should be observed if the market perceived that the FASB was going to re-examine SFAS No. 8 and possibly change to a method that would not prompt speculation and hedging activities.

The announcement in the *Wall Street Journal* on July 8, 1977, that the FASB was sponsoring research further implied that the FASB was considering a re-examination of foreign currency translation methods. While the announcement of the FASB's sponsoring of research should indicate a higher probability of a favorable revision to SFAS No. 8, its effects may be minimal since the Board's interest in such research was already known.

The first direct statement regarding a possible modification of SFAS No. 8 occurred on October 10, 1977, when the *Wall Street Journal* carried a story which announced that the FASB was considering a technical change in SFAS No. 8. A strong positive market reaction to this announcement is expected since it is the first explicit acknowledgment that SFAS No. 8 might be modified. On June 2, 1978, the FASB announced its solicitation of comments regarding SFAS No. 8 and foreign exchange reporting practices. Again, observation of a positive reaction is expected since the announcement implies that public feedback, which would likely be negative toward SFAS No. 8, would be considered in developing an alternative to SFAS No. 8. During January 1979, the FASB announced that it was going to reconsider SFAS No. 8 and formally acknowledged that SFAS No. 8 was likely to be changed. Also during January 1979, the FASB announced the results of its sponsored research.

The *Wall Street Journal* reported the FASB's tentative agreement regarding changes in the accounting for foreign currency translation on April 11, 1980. On August 28, 1980, an exposure draft of SFAS No. 52 was released and the first official release of its contents was made. Table 1 contains a chronicle of the events and the dates of their release in the *Wall Street Journal* as well as the sign of the overall expected market reaction.

As stated in the prior section, the methods of accounting used prior to the issuance of SFAS No. 8 are believed to be an important control variable in assessing the cost of the statement to a particular firm. The pre-SFAS No. 8 accounting methods can be classified according to two dimensions: (1) the

TABLE 1
EVENTS LEADING UP TO SFAS NO. 52 AND EXPECTED MARKET REACTION OF MNC

Test Period	*Date*	*Event*	*Sign of Expected Market Reaction of MNC*
1	December 31, 1974	Exposure draft of SFAS No. 8	−
2	October 6, 1975	SFAS No. 8	−
3	April 29, 1976	FASB votes not to reconsider SFAS No. 8	−
4	April 19, 1977	FASB announces its interest in research regarding foreign currency translation	+
5	July 8, 1977	FASB announces it will sponsor research regarding foreign currency translation	+
6	November 10, 1977	FASB proposes a technical change in SFAS No. 8	+
7	June 2, 1978	FASB solicits comments regarding a change in SFAS No. 8	+
8	January 18, 1979 January 31, 1979	FASB announces results of its sponsored research FASB votes to reconsider SFAS No. 8	+
9	April 1, 1980	*Wall Street Journal* reports the tentative changes	+
10	August 28, 1980	FASB releases an exposure draft of SFAS No. 52	+

measurement method employed, and (2) the method of disposal regarding translation gains and losses. Three major types of measurement methods can be identified. They are the current/noncurrent method, the monetary/nonmonetary method, and the hybrid method. There are also three major types of disposal methods used prior to SFAS No. 8. These methods include direct write-off of all gains and losses, deferral of all gains and losses, and deferral of gains but direct write-off of all losses.

The effects of the pre-SFAS No. 8 measurement method on the expected market reactions to SFAS No. 8 and SFAS No. 52 are not clear *a priori.* Firms that were using the current/noncurrent method for measurement prior to SFAS No. 8 should have a negative reaction to SFAS No. 8 since it required the use of the monetary/nonmonetary approach. Firms that were already using a monetary/nonmonetary approach prior to SFAS No. 8 were not affected by the issuance of SFAS No. 8. Firms using a hybrid measurement method could have been affected either positively or negatively.

In regard to SFAS No. 52, the impact of the pre-SFAS No. 8 measurement method on the observed market reactions also cannot be specified since the actual method employed is firm- and country-specific. Through the functional currency approach, the MNC may be required to use either the current rate method or the monetary/nonmonetary method and it may use different methods for operations in different countries.

However, the effects of the pre-SFAS No. 8 method of accounting for gains and losses on the observed market reactions to SFAS No. 8 and SFAS No. 52 are rather straightforward. The pre-SFAS No. 8 method of disposal of gains and losses should result in negative reactions to SFAS No. 8 for firms that used a deferral method. No reaction is expected for firms using the direct write-off approach since this approach is consistent with the reporting requirements of SFAS No. 8. For firms that deferred gains and recognized losses prior to SFAS No. 8, the expected effect of SFAS No. 8 is mixed. The reaction to SFAS No. 52 is expected to be positive for all three disposal method groups, since SFAS No. 52 eliminated the required recognition of gains or losses in most instances.

RESEARCH HYPOTHESES, DESCRIPTION OF THE SAMPLE FIRMS, AND THE METHOD OF COMPUTING ABNORMAL RETURNS

To address the first two research purposes discussed in the first section, the following hypothesis (stated in the alternative form) is tested for each of the ten event periods discussed in the previous section:

> Hypothesis 1: The announcement of the change in accounting standard or promulgation event had a positive (negative) impact on the security returns of MNCs.[1]

This hypothesis is tested using the average standardized cumulative abnormal return for the whole sample.

The following hypothesis (stated in the alternative form) is used to test the third research purpose:

> Hypothesis 2: The pre-SFAS No. 8 method of accounting for foreign currency translation chosen by an individual firm had an impact on the reaction that resulted from the change in accounting standard or the announcement of a promulgation event.

To test this hypothesis, an analysis of variance is conducted and the standardized cumulative abnormal returns are computed for each subsample of firms that were using the same pre-SFAS No. 8 method.

Our empirical work is based on a large sample of MNCs. An initial sample of 524 firms is randomly chosen from all the United States-based MNCs listed in Stopford's *The World Dictionary of Multinational Enterprises 1982–1983* and the 479 MNCs used in the Dukes [1978] study. To be included in the final sample, each firm must meet the following screens:

1. Complete requisite return data must be available on the daily CRSP tape for the period from November 19, 1973, to December 18, 1981.
2. Information must be available in *Disclosure Journal* to determine both the measurement method and the disposal method used prior to SFAS No. 8.
3. The firm must have been in existence throughout the time period of analysis.

The application of these criteria yields a final sample of 286 MNCs.

The potential problem of cross-sectional correlation (due to industry

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[1] As summarized in Table 1, the reaction is expected to be negative for events 1 through 3 and positive for events 4 through 10.

TABLE 2
NUMBER OF SAMPLE FIRMS CLASSIFIED BY FOREIGN CURRENCY METHOD USED PRIOR TO SFAS NO. 8

Current/Noncurrent with Direct Write-Off	91 firms
Current/Noncurrent with Deferral	34 firms
Current/Noncurrent with Deferral of Gains and Write-Off of Losses	33 firms
Monetary/Nonmonetary with Direct Write-Off	29 firms
Monetary/Nonmonetary with Deferral	12 firms
Monetary/Nonmonetary with Deferral of Gains and Write-Off of Losses	2 firms
Hybrid Method with Direct Write-Off	55 firms
Hybrid Method with Deferral	21 firms
Hybrid Method with Deferral of Gains and Write-Off of Losses	9 firms

effects) among the abnormal returns should be minimized since this sample represents 103 industries based on the four-digit SIC industry code. Of the industries in the sample, 49 have only one firm and 45 have between two and five firms.

An analysis of the pre-SFAS No. 8 foreign currency reporting practices of the sample is conducted by referring to *Disclosure Journal*. The firms are classified into nine groups based on the method of foreign currency reporting used prior to SFAS No. 8. The nine groups correspond to the nine possible combinations regarding the three valuation methods and the three disposal methods. Table 2 lists the nine pre-SFAS No. 8 accounting method groups and the numbers of firms in each group.

The average standardized cumulative abnormal return (SCAR) is computed for each of the ten event periods denoted in Table 1. For each of the test periods, SCAR is measured over a period six weeks prior to the week of the event (week −6) through the week subsequent to the week of the event (week +1). This is accomplished by estimating a market model for the 52 weeks prior to the test period for each of the events studied.[2] Daily CRSP returns are aggregated to form weekly returns and they are regressed against the market returns to estimate the parameters of a market model for each firm.

The estimated parameters are then used to compute an abnormal weekly return for each of the weeks in the test period. The weekly abnormal returns are standardized by scaling the abnormal weekly return by the variability of the residuals around the estimated regression equation of the estimation period. Accordingly, the weekly abnormal return is divided by the mean standard deviant adjusted for prediction outside of the estimation period to provide standardized abnormal returns. These are then summed cross-sectionally (for the particular sample analyzed) to provide the average standardized abnormal return. The average standardized cumulative return is computed as the sum of the average standardized abnormal returns for the eight weeks in the test period divided by the square root of eight (the number of weeks in the cumulating sum).[3]

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[2] A potential problem may be that the estimation of the market model for a particular event period such as period 2 is based on an estimation period that includes event period 1 if 52 weekly observations prior to event 2 are used. To alleviate this problem, we conducted analyses (in addition to the 52-week approach) using an alternative 26-week estimation period for instances in which a previous test period would be included in the estimation period. These analyses are reported in footnote 4.

ANALYSES

The first analysis, which tests hypothesis 1, focuses on the average standardized cumulative abnormal return (SCAR) across all of the sample firms. For the three events expected to have a negative market reaction (related to SFAS No. 8 and its likely continuation), test periods 1, 2, and 3, a combined SCAR across all three test periods is −3.3557. This is significant at the .001 level for a one-tailed *t*-test. For the events expected to have an overall positive reaction (related to modification of SFAS No. 8), test periods 4 through 10, the SCAR is +2.9081 which is significant at the .001 level. These results suggest that SFAS No. 8 had a negative effect on market prices and that the market reacted favorably to SFAS No. 52.

Our ability to observe a significant negative market reaction to SFAS No. 8 events in light of the inability of Dukes [1978] and Makin [1978] to find a significant negative reaction to SFAS No. 8 may be due to a number of reasons. As pointed out by Ziebart [1985], the use of standardization to control for beta reliability in studies of abnormal return magnitudes may be beneficial when the magnitude of the effect being investigated is small. In addition, both the Dukes study and the Makin study use very long test periods. The shortest test period employed by Dukes encompasses two calendar years while the shortest test period employed by Makin is five months. Brown and Warner [1980] emphasize that shortening the test period around the date of the event increases the ability to pick up abnormal returns. This study uses much smaller test periods, which increases our ability to find abnormal return reactions.

Table 3 provides the average standardized cumulative abnormal returns for each of the ten test periods.[4] *A priori*, we expected negative abnormal returns associated with SFAS No. 8 since it stimulated costly hedging activities that resulted in negative cash flows. Our results confirm this relationship for the individual test period 2, the issuance of SFAS No. 8. However, no significant reaction to the exposure draft of SFAS

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[3] For a description of the standardization process and its motivation see Patell [1976]; Hong, Kaplan, and Mandelker [1978]; and Ziebart [1985].

[4] For each of the test periods in which an estimation period of 52 weeks would indicate a previous event period (i.e., all except 1 and 9), we estimated the market model using 26 weeks and computed the average SCARs. The event period, the alternative estimation period used, and the computed average SCAR are as follows:

Test period 2: Alternative estimation period of 26 weeks prior to the event period; SCAR = −3.4128;

Test period 3: Alternative estimation period of 26 weeks prior to the event period; SCAR = −4.1826;

Test period 4: Alternative estimation period of 26 weeks prior to the event period; SCAR = .7009;

Test period 5: Same alternative estimation period used for test period 4; SCAR = −4.1549;

Test period 6: Same alternative estimation period as used for test period 4; SCAR = 2.1492;

Test period 7: Alternative estimation period of 26 weeks prior to the event period; SCAR = 1.8512;

Test period 8: Alternative estimation period of 26 weeks prior to the event period; SCAR = 2.7098;

Test period 10: Alternative estimation period of 26 weeks prior to test period 9; SCAR = 7.0911.

A comparison of these results to those in Table 3 shows little difference between the results. The signs are the same in all cases but the level of significance may differ.

TABLE 3
AVERAGE STANDARDIZED CUMULATIVE ABNORMAL RETURNS FOR THE TEN TEST (EVENT) PERIODS

Test Period and Event	*SCAR*	*Significance*
1. Exposure draft of SFAS No. 8	.9837	
2. SFAS No. 8	−2.6712	<.01
3. FASB votes not to reconsider SFAS No. 8	−4.1248	<.001
4. FASB announces its interest in research regarding foreign currency translation	1.8719	
5. FASB announces it will sponsor research regarding foreign currency translation	−4.1682	<.001
6. FASB proposes a technical change in SFAS No. 8	3.0705	<.01
7. FASB solicits comments regarding a change in SFAS No. 8	3.6091	<.001
8. FASB announces results of its sponsored research and FASB votes to reconsider SFAS No. 8	.0203	
9. FASB releases an announcement of a tentative change	−3.2929	<.01
10. SFAS No. 52 exposure draft	6.5833	<.001

No. 8 (test period 1) is observed. We believe that there are a number of plausible explanations for this result. One possibility is that the effect was obscured by other events associated with the calendar year-end (note that the exposure draft was issued on December 31, 1974). Alternatively, the abnormal returns may have captured some of the "January effect" since the test period includes the first weeks of January.[5] Also, the market may not have fully understood the implications of SFAS No. 8 until later since its details were not known prior to its release. Finally, confounding events such as earnings announcements may affect the observed reactions.[6]

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[5] See Keim [1983], Roll [1982], or Reinganum [1983] for a detailed description of the "January effect."

[6] To more fully examine the effect of confounding due to the announcement of earnings, we reviewed the *Wall Street Journal Index* to determine firms with confounding events during the test period. We computed the average SCAR deleting all firms with an earnings announcement and all firms with earnings announcements, dividend announcements, announcements of forecasts, or announcements of merger activity. For the first test period the results are:

(1) SCAR = .2844, $n = 237$;
(2) SCAR = .5387, $n = 136$.

The results for the second test period are:

(1) SCAR = −2.3537, $n = 227$;
(2) SCAR = −1.8233, $n = 161$.

These results are consistent with the results obtained for the initial sample and indicate that the confounding events do not significantly affect the results.

Given the observation of a significant overall negative reaction to SFAS No. 8 (test period 2) and assuming that there was non-zero probability of its revision, an overall negative market reaction is expected to the announcement that the FASB had voted not to reconsider SFAS No. 8 (test period 3). The results support an overall negative market reaction at a fairly high level of significance. The vote not to reconsider SFAS No. 8 was interpreted by the market as a statement by the FASB that SFAS No. 8 would not be rescinded or changed in the near future.

Test period 4, which focuses on the FASB's announcement of its interest in research regarding foreign currency translation methods, has no overall significant price reaction. This indicates that the market did not perceive this to be a significant event that might lead to a change in SFAS No. 8. Evidently, an increase in the probability of a change was not indicated to the market by the FASB announcing its interest in research on foreign exchange reporting practices.

A positive market reaction is expected to accompany the announcement that the FASB was sponsoring research on foreign currency translation (test period 5), but the empirical results display a significant negative reaction. The market may have interpreted the announcement as an indication that a revision would not come before perhaps lengthy research projects were completed. A significant positive reaction is found for test period 6, as expected, since this is the first direct acknowledgment by the FASB that it may reconsider SFAS No. 8. A positive reaction is also observed for the test period regarding the solicitation of comments (test period 7). Test period 8, which combines the announcement of the reconsideration of SFAS No. 8 and the research results, has no significant reaction.

The next test period (period 9), which measures the market reaction to the *Wall Street Journal* (*WSJ*) announcement of a tentative agreement, has a significant negative average SCAR. This result is contrary to our expectation of a positive market reaction. A plausible reason for this negative reaction is that at the time of the *WSJ* announcement the decision of the FASB was unclear. The exposure draft was favored by the members of the FASB by four to three but the decision rule at that time was five to two. In addition, the *WSJ* report indicated that the position of the FASB was not fixed at that time and that the FASB would not issue a press release or detailed information until later. The ambiguous nature of the announcement as to the nature and timing of a change apparently was less favorable than had been expected.

The final test period of this study, the release of the exposure draft for SFAS No. 52, results in a significant positive reaction and confirms our expectation of a positive market reaction to SFAS No. 52.

To test hypothesis 2, concerning the effect of the pre-SFAS No. 8 accounting method, all of the firms are classified into three groups based on their pre-SFAS No. 8 measurement method and three groups based on their pre-SFAS No. 8 method for disposition of gains or losses from foreign exchange translation. An analysis of variance is conducted on the standardized cumulative abnormal returns (SCAR) to determine whether the pre-SFAS No. 8 accounting method differentially affects the observed market reaction for each of the test periods.

Results of the analyses indicate significant main effects due to the measurement method differences in two of the test periods, while the disposal method differences are significant in one instance. Finally, the interaction effects are signif-

TABLE 4

AVERAGE STANDARDIZED CUMULATIVE ABNORMAL RETURNS FOR PRE-SFAS NO. 8 MEASUREMENT METHOD GROUPS[a]

Test Period and Event	*Current/ Noncurrent* ($n=155$)	*Monetary/ Nonmonetary* ($n=44$)	*Hybrid* ($n=87$)
1. SFAS No. 8 Exposure Draft	.8777	−.1065	.6830
2. SFAS No. 8 issued	−2.4275*	−1.7093	−.3908
3. FASB votes not to reconsider SFAS No. 8	−3.9813**	−.1140	−2.0674*
4. FASB announces its interest in research regarding foreign currency translation	2.0513*	.7615	.1118
5. FASB announces it will sponsor research	−3.0749**	−.6022	−3.0165**
6. FASB proposes a technical change in SFAS No. 8	1.6404	2.2721*	1.9731
7. FASB solicits comments regarding a change	2.3060*	.7033	2.9576**
8. FASB announces the results of its sponsored research and votes to reconsider SFAS No. 8	.5185	−.8795	−.6752[b]
9. FASB announces a tentative change	−4.2435**	.6545	−.7499[b]
10. SFAS No. 52 exposure draft	5.6129**	1.1152	3.6760**

[a] significance level using a two-tailed t-test: $** < .01$; $* < .05$

[b] F-statistic indicates differences significant at the .01 level

icant for three of the ten test periods. For test periods 2 and 5, the interaction effect of the measurement method and the disposal method has a significant effect at the .01 level and for period 7 the interaction is significant at the .07 level.

The measurement method has a significant effect during period 8 (vote to reconsider) and period 9 (the *WSJ* report of a tentative change). During the other test periods the pre-SFAS No. 8 accounting method has no differential effect on the market reactions. These results do not strongly or consistently support the notion that the pre-SFAS No. 8 method of accounting has an effect on observed market reactions.

To more fully analyze the effect of the *pre-SFAS No. 8 measurement method* on the market's reaction to the events leading up to SFAS No. 52, the firms are divided into three groups based on their pre-SFAS No. 8 measurement method and the average SCAR and t-statistic are computed for each of the three groups across each of the ten test periods. These results are presented in Table 4.

The signs of the average SCARs are consistent across all three groups in seven of the ten test periods. In the three test periods in which the SCAR signs are not consistent, only the results of test period 8 have a significant value. The current/noncurrent measurement group

TABLE 5

AVERAGE STANDARDIZED CUMULATIVE ABNORMAL RETURNS FOR THE PRE-SFAS NO. 8 DISPOSAL OF GAINS OR LOSSES GROUPS[a]

Test Period and Event	*Direct Write-Off* ($n=169$)	*Deferral* ($n=69$)	*Hybrid* ($n=48$)
1. SFAS No. 8 Exposure Draft	.8010	1.1111	−.4417
2. SFAS No. 8 issued	−2.5948**	−.8487	−.6429
3. FASB votes not to reconsider SFAS No. 8	−3.9283**	−.9472	−1.5237
4. FASB announces its interest in research regarding foreign currency translation	.4470	1.8571	1.5594
5. FASB announces it will sponsor research	−3.5020**	−1.6175	−1.6496
6. FASB proposes a technical change in SFAS No. 8	3.3905**	.1000	.9604
7. FASB solicits comments regarding a change	2.9533**	.4367	2.4398*
8. FASB announces the results of its sponsored research and votes to reconsider SFAS No. 8	.4347	−1.2630	.7319
9. FASB announces a tentative change	−3.5963**	.6249	−1.9903[b]
10. SFAS No. 52 exposure draft	4.8843**	2.7383**	3.6382**

[a] significance level using two-tailed t-test: ** < .01; * < .05

[b] F-statistic indicates differences significant at the .09 level

has statistically significant SCARs in seven of the ten test periods. The monetary/nonmonetary group has significant SCARs in only two of the test periods and they are periods in which the results for the current/noncurrent group are insignificant. For the hybrid group there are four test periods of significant average SCARs.

Only in the first test period are all the SCARs non-significant for all three groups. The reactions observed for the current/noncurrent group compared to the monetary/nonmonetary group support the notion that the pre-SFAS No. 8 measurement method does differentially affect returns. One would expect little reaction to SFAS No. 8 for the firms using the monetary/nonmonetary approach, and this is confirmed by the results. In addition, the significant market reactions for the current/noncurrent group uphold the *a priori* expectation, since SFAS No. 8 curtailed the use of this approach.

To analyze the effect of the *pre-SFAS No. 8 method of disposal of the gains or losses* from the foreign currency translation, the sample firms again are divided into three groups based on their pre-SFAS No. 8 accounting method and the average SCAR is computed for each of the ten test periods. Table 5 contains the results.

The signs of the average SCARs are consistent across the three groups in seven of the ten test periods. The direct write-off group has a significant SCAR in seven of the ten periods while the deferral group is only significant in the last test period. The hybrid method group results show significant reactions in test periods 7 and 10. All three groups consistently show no reaction in test periods 1, 4, and 8 and they all show a positive reaction in period 10.

A priori, we expected most of the negative reactions to SFAS No. 8 to be observed for firms that were required to switch from the deferral method to the direct write-off method. The results are to the contrary. Most of the observed significant market reactions are observed for the group that was using the direct write-off method before it was required by SFAS No. 8. This is quite surprising and may be the result of the firm characteristics that prompted the firms to choose the direct write-off method prior to its being required. A firm's choice of the direct write-off method may have provided it with a competitive advantage (either real or perceived) that was mitigated when the method was required for all firms.

The results of these cross-sectional analyses provide evidence that the financial markets did react to the promulgation process associated with SFAS No. 8 and SFAS No. 52. Overall, our results provide evidence that the market did react negatively to SFAS No. 8 and positively to SFAS No. 52. The average SCARs of the total sample are significant in seven of the ten test periods and the signs of the results are in the expected direction in all but two of the test periods. The analyses of the effects of the pre-SFAS No. 8 reporting practices provide weak and mixed evidence that the market reactions do vary depending upon the pre-SFAS No. 8 accounting method employed. However, these differential reactions are not completely as we had expected *a priori.*

SUMMARY AND CONCLUSIONS

Previous research regarding the impact that SFAS No. 8 had on multinational firms indicates that it increased earnings variability and prompted many multinational firms to undertake costly hedging activities. Market price reaction tests have been inconclusive. The results of this study indicate a statistically significant negative market reaction to SFAS No. 8 overall. Given the common belief that SFAS No. 52 eliminated most of the detrimental effects of SFAS No. 8, one expects to observe a positive reaction to its issuance. Statistically significant positive market reactions are found in this study regarding SFAS No. 52.

This study investigated ten plausible event periods regarding SFAS No. 8 and SFAS No. 52. Three of the ten event periods were expected to have negative reactions *a priori* while the other seven were expected to have positive reactions. Of the three periods expected to have a negative reaction (the exposure draft of SFAS No. 8, the issuance of SFAS No. 8, and the vote not to reconsider SFAS No. 8), statistically significant negative reactions are found for the latter two events. Four statistically significant positive reactions, two significantly negative reactions, and one period of no reaction are observed for the seven hypothesized positive reaction test periods.

A very strong negative reaction is observed for test period 3 when the FASB voted not to reconsider SFAS No. 8. This implies that the financial community may have expected the FASB to modify SFAS No. 8. Three very strong positive reactions are observed regarding the promulgation process which led to

SFAS No. 52. The proposal of a technical change in SFAS No. 8 by the FASB and the FASB's solicitation of comments regarding a change in SFAS No. 8 are deemed to be significant promulgation events by the market. However, the strongest market reaction observed is that which accompanied the issuance of the SFAS No. 52 exposure draft.

This study hypothesized that the pre-SFAS No. 8 method of accounting should affect the market reactions accompanying the ten promulgation events studied. In effect, the results indicate that the pre-SFAS No. 8 method is associated with the market reactions but the effect is mixed and not always as expected. In the analysis of the pre-SFAS No. 8 measurement method effect, it was expected that the firms that SFAS No. 8 required to switch to a contrary method would have significant negative reactions to SFAS No. 8 and positive reactions to SFAS No. 52. The empirical results uphold this relationship. It was also expected that the pre-SFAS No. 8 method of disposal for gains and losses on foreign currency translation should affect the associated market reactions. Firms that were using a direct write-off approach prior to SFAS No. 8 were expected to have little or no reaction to SFAS No. 8 while firms using a deferral approach prior to SFAS No. 8 were expected to have significant negative reactions. The empirical results indicate the contrary. The pre-SFAS No. 8 direct write-off firms have significant negative reactions to SFAS No. 8 and significant positive reactions to SFAS No. 52. The pre-SFAS No. 8 deferral method firms have no significant reaction to SFAS No. 8 but do react positively to the issuance of the exposure draft for SFAS No. 52.

In summary, the results of this study indicate that changes in the accounting standard for foreign currency translation did have an impact on the capital market. The market reacted negatively to SFAS No. 8 and positively to SFAS No. 52. These results are consistent with the notion that SFAS No. 8 and SFAS No. 52 affected investors' prospects regarding MNCs in opposite directions.

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Income Smoothing and Incentives: Empirical Tests Using Accounting Changes

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ABSTRACT: In this study it is hypothesized that various firm-specific factors provide incentives for management to use accounting choices to smooth earnings, and that as a result, smoothing behavior varies across firms. Accounting changes are investigated as a smoothing device. *T*-tests and regression analysis are used to test the relation between smoothing and a set of explanatory variables. Findings provide evidence that smoothing is associated with firm size, the existence of bonus compensation plans, and the divergence of actual earnings from expectations. In addition, findings indicate that smoothing by accounting changes is associated with the impact of the accounting change on the level of earnings. This is consistent with management recognizing and making trade-offs between the effect of accounting choices on both income levels and income variability.

STUDIES of the economic consequences of accounting choices (see Kelly [1983] and Holthausen and Leftwich [1983] for reviews) have developed factors to explain different accounting actions across firms. Examples include taxes, political costs, contractual relationships, and ownership control. Generally, past studies have implicitly hypothesized that such factors would motivate firms to use accounting choices to maximize or minimize reported earnings and consequently have sought an empirical association between economic consequences variables and the impact of accounting choices on the level of earnings.

The income smoothing literature, however, has argued that accounting choices will be used to reduce earnings fluctuations rather than to maximize or minimize reported earnings, and has documented the use of accounting choices in smoothing. (See Ronen and Sadan [1981] for a review.) The premise of this paper is that some of the factors identified in the economic consequences literature may motivate smoothing behavior. The purpose of the paper is to test for associations between smoothing and variables commonly used to proxy for particular economic factors.

The idea that firms use accounting techniques to smooth or normalize earnings has long been discussed and investigated in the accounting literature. Despite

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the large number of empirical smoothing studies, all tended to ask the same basic question: Is smoothing practiced? Each study addressed this question using the same basic approach: First, a particular discretionary action (e.g., accruals, accounting techniques) was hypothesized as a smoothing device. Second, a method was used to determine whether the smoothing device reduced fluctuations in earnings. Third, statistical tests were performed to determine whether the incidence of identified smoothing behavior in the sample was greater than would be predicted by random behavior or chance.

There are three problems with this approach.

1. Because there is little agreement by researchers on precisely how to identify smoothing behavior empirically, the measurement of smoothing is *ad hoc*. Consequently, when a method identifies a firm as having smoothed it may be the result of actual smoothing by the firm or an artifact of how smoothing is measured.
2. Past studies generally based conclusions on the degree or frequency of apparent smoothing behavior identified among sample firms. However, much of what appears as smoothing may occur "naturally," i.e., without any conscious intent by management to regulate fluctuations in its income series. There may be a natural or uncontrolled co-movement between a smoothing device and earnings dictated by the technology of operations [Ronen and Sadan, 1981]. For example, in poor years, expenses that are technologically related to volume may be cut back, thus moderating a downward fluctuation in earnings. Whether the apparent smoothing effect of expense reduction is an inherent result of a shift in volume or an intentional adjustment to the earnings series is unknown. Drawing conclusions about smoothing based simply on the frequency with which some potential smoothing device reduces earnings fluctuations in a sample assumes that natural smoothing does not occur.
3. Even if intentional smoothing could be determined, identification of smoothing *per se* does not permit inferences as to why smoothing may be practiced. Previous studies have made little attempt to link observed smoothing behavior to specific assumed motivations.[1]

Ball and Foster [1982] have criticized the smoothing literature for not factoring motivations into the research design. Lambert [1984] suggests that the proper test for smoothing is to determine whether smoothing is more in evidence when there is relatively greater incentive for it to exist. This paper tests for differential smoothing behavior as a function of incentives by investigating the association between the degree of apparent smoothing behavior exhibited within a sample of firms and firm-specific explanatory variables that proxy for factors that may motivate smoothing. This approach partially alleviates the three problems mentioned above, as follows:

1. While the measurement of smoothing is still *ad hoc*, if predicted associations between smoothing and

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[1] Exceptions are Smith [1976] and Kamin and Ronen [1978], who hypothesized that smoothing behavior would be inversely related to the degree of ownership control experienced by management. Smith found support for his hypothesis. Kamin and Ronen found that results depended on firm barrier to entry, but their strongest findings were contrary to the ownership control hypothesis.

explanatory variables are observed, the method of identifying smoothing is indirectly validated. The approach is a joint test of smoothing measurement and smoothing explanation.

2. Conclusions are not based simply on the overall degree or frequency of apparent smoothing identified in the sample, but rather on the relative degree of smoothing across situations of hypothesized differential incentives. Observation of greater smoothing associated with specific variables provides a stronger basis for inferring smoothing by design rather than by chance.
3. Tests of association between smoothing and specific variables provide a first step in linking smoothing behavior to underlying motivations.

The remainder of the paper is organized as follows. The first section defines and discusses the measurement of smoothing and the second identifies a set of firm-specific explanatory factors. The third and fourth sections analyze the association between explanatory variables and smoothing. The final section provides conclusions.

SMOOTHING BEHAVIOR OPERATIONALIZED

Smoothing behavior is defined as an effort to reduce fluctuations in reported earnings. Researchers generally have agreed that smoothing involves the use of some "smoothing device" to reduce the divergence of reported earnings from an earnings number that is "normal" or "expected" for the firm. Thus, two items must be chosen to measure smoothing: the smoothing device and a measure of earnings towards which management is assumed to shift reported earnings.

The Smoothing Device—Accounting Changes

Discretionary accounting changes were selected as the smoothing device to investigate for several reasons. First, accounting changes can have a material impact on reported earnings and consequently are unlikely to be adopted without management consideration of the effects. Second, no assumption needs to be made concerning the magnitude of the discretionary component of an accounting change. One could test other items, such as accruals or discretionary expenses as smoothing devices, but the researcher must then divide the total accrual or expense into a portion considered normal and a remainder assumed to reflect the discretionary component. Such separation is a non-trivial process since factors besides intentional adjustment by management, such as the volume of operations, can be expected to influence the amount of accruals or expenses [Ronen and Sadan, 1981]. In addition, findings in smoothing studies can be sensitive to the way the discretionary component is isolated [Moses, 1979]. Accounting changes, however, provide a measure that is purely discretionary.

The use of accounting changes as a measure of smoothing behavior also has deficiencies. First, accounting changes are visible and it may be argued that management would prefer techniques that are more subtle and do not require disclosure. Second, there are non-smoothing reasons for making accounting changes (e.g., to use LIFO for tax purposes). However, no assumption is made here that accounting changes are made solely to smooth earnings. Nor does this paper claim to explain why changes are adopted. Rather, it is assumed that the smoothing effect of a change is one consideration that constrains or influences change.

TABLE 1

DISCRETIONARY ACCOUNTING CHANGES BY YEAR AND TYPE

Type	*1975*	*1976*	*1977*	*1978*	*1979*	*1980*	*Total*	*Percent*
Switch to LIFO	20	8	5	9	25	31	98	46
Change in Pension Method or Assumptions	17	18	5	7	11	3	61	29
Non-Inventory, Non-Pension Method Changes (e.g., Depreciation, Tax Credit, Consolidation)		1	4		8	1	14	7
Changes in Amortization, Depreciation Estimates	2	1			2	1	6	3
Changes in Expense/Capitalization Policies	5		1	1	2	1	10	5
Other	1	1	2	1	1	2	8	4
Multiple Changes in One Period	3	1		2	5	4	15	7
Total	48	30	17	20	54	43	212	
Percent	23	14	8	9	26	20		100

Sample

A review of Accounting Trends and Techniques (ATT) for 1975–80 provided an initial sample of 1,483 firms reporting accounting changes. Firms were deleted from the sample for one (or more) of the following reasons: the accounting change was mandatory rather than discretionary (approximately 60 percent of the ATT sample); proxy statements and Form 10-Ks could not be obtained (six percent); there was no earnings impact of the accounting change, the impact was reported by the firm as immaterial, or the impact was not disclosed (17 percent); the change required restatement of prior years' earnings (one percent); or data for ten years preceding the change were not available on COMPUSTAT (one percent).

Deletions reduced the original sample to 231 discretionary accounting change events (16 percent of the ATT population). If a particular firm adopted more than one discretionary change in a given year, the effects were aggregated and the package was treated as a single event.[2] This further reduced the sample size to 212 discretionary accounting change events. Table 1 provides a description of the sample events by type of change and year of adoption. Using two (four)-digit SIC codes from COMPUSTAT, 29(85) industries were represented in the sample.

Expected Earnings

Smoothing researchers must select an "expected" earnings number that the firm is assumed to smooth toward. Expected earnings is used as a reference point from which measures of the deviation of actual earnings can be developed. Past smoothing studies have used models based on past earnings of the firm and/or the current performance of other firms in the industry. A simple random walk model, predicting earnings in any year as equal to reported earnings in the previous year, is used for the tests reported in this paper.[3] The random walk model is the most frequently used expectations model in previous smoothing studies. Income before extraordinary items (ordinary income) is used because extraordinary items represent nonrecurring items that constitute "noise" when trying to predict future earnings. In addition, ordinary income is the series that firms are thought to be most likely to smooth [Ronen and Sadan, 1981, 1975].

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[2] This treatment follows from Zmijewski and Hagerman [1981]. Their work suggests that management does not select individual accounting procedures independently of others. Instead, a portfolio of procedures is selected to achieve an income strategy.

The Smoothing Measure

Smoothing was measured as the degree to which an accounting change shifts income toward expected earnings (*EE*).[4] For each sample firm the earnings number that would have been reported had the firm not adopted the accounting change was determined and termed prechange earnings (*PE*). A measure of smoothing behavior (*SB*) was calculated by comparing the deviations of prechange and reported earnings (*RE*) from expectations. Since *PE*, *RE*, and *EE* are all undeflated measures and consequently dependent on firm size, sales was used here (and later in other variables) as a deflator.[5]

$$SB=\frac{|PE-EE|-|RE-EE|}{Sales}$$

Positive values of *SB* are consistent with smoothing; 137 of the 212 firms, or 65 percent, are classified as having smoothed income.

EXPLANATORY VARIABLES

Economic Consequences Variables

The links between accounting choices and economic consequences have been widely discussed in the literature (e.g., Benston and Krasney [1978] and Holthausen and Leftwich [1983]) and no in-depth review is offered here. What follows is a list of factors, statements of why the factors may be associated with smoothing, and measures used as proxies. Measures used here have had considerable prior use in related studies. Despite such usage, some variables are imprecise proxies and have been criticized as such (e.g., Ball and Foster [1982]). Thus, conclusions must be tempered by this limitation.

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[3] Expected (or "normal" or "target") earnings in the smoothing literature is analogous to expected earnings used in studies of the securities market association with accounting numbers (e.g., Ball and Brown [1968]; Beaver et al. [1979]). Expected earnings in smoothing studies represent an assumed goal of management, while expected earnings in market studies represent the market's expectation. In principle, the two numbers may differ. In practice, the models used to generate the number have been similar.

Since the actual income number a firm's management may smooth toward is unknown, no claim can be made that any single expectations model is most appropriate. Four other expectations models were used in the study. The models determined expected earnings in terms of: (1) Prior year's earnings plus average earnings growth over five preceding years (a random walk with drift). (2) Average return on assets over five preceding years. (3) Prior year's earnings plus average growth in earnings within the firm's industry. (4) Prior year's earnings plus a growth factor contingent on the firm's prior year price-earnings ratio. Models similar to the first three, as well as the random walk, have been used in previous smoothing studies. The last expectations model used an approach analogous to that of Beaver et al. [1980], predicting earnings as a lagged function of security prices. Expectations from the five models also were averaged to form a consensus expected earnings. Such an approach is advocated by Granger and Newbold [1977] and Beaver [1981]. Tests were conducted using the individual and consensus expected earnings. Overall findings and conclusions were not dependent on the calculation of expected earnings.

[4] Focusing on the smoothing effects of an accounting change in the single period the change is adopted can be criticized because accounting changes may have effects (perhaps non-smoothing) in future periods. However, managers frequently are described as being overly concerned with short-run effects of decisions, hence the short-run impact of the change may dominate or at least is not unimportant. Furthermore, because of uncertainties in future economic events and future earnings, the effects of an accounting change on future earnings variability may be difficult for management to project. Most important, disclosed data are only sufficient to develop objective measures of the earnings impact of a change in the period the change is adopted. Several previous studies [Archibald, 1967; Copeland, 1968; Copeland and Licastro, 1968; Cushing, 1969; Dopuch and Drake, 1966; Gagnon, 1967; Gordon et al., 1966; Smith, 1976; White, 1970] have used a one-period perspective. There is a real division in the empirical smoothing literature between one-period studies, which treat smoothing as a short-run normalization process, and multiperiod studies, which treat smoothing as a long-run variability reduction process. Both phenomena go by the label of smoothing. In a review of smoothing studies, Moses [1979] suggests that one-period studies may reflect attempts to smooth while multiperiod studies may capture achievement of smoothing.

[5] Use of an earnings number as a deflator is problematic because a very low level of earnings would create a very high smoothing measure even when the absolute dollar impact of the accounting change effect may be

Firm Size/Political Costs.[6] Firms in the public eye and objects of government scrutiny are subject to actions by government or the public that may impose costs [Watts and Zimmerman, 1978; Hagerman and Zmijewski, 1979; Benston and Krasney, 1978]. Large fluctuations in earnings may attract the attention of regulators [Benston and Krasney, 1978]. Large upward earnings fluctuations may be perceived as a signal of monopolistic practices; large downward fluctuations may signal crisis and cause regulators to act [Ronen and Sadan, 1981]. Exposure to scrutiny and imposed costs may be related to firm size [Gagnon, 1967; Siegfried, 1975; Zimmerman, 1983]. Consequently, larger firms may have a greater incentive to smooth. In this study, firm size (SIZE) is measured by total sales in the year of the accounting change.

Market Share/Political Costs. Hagerman and Zmijewski [1979], Zmijewski and Hagerman [1981], and Watts and Zimmerman [1978] have argued for an association between political costs and the market power possessed by the firm. Market power increases the probability of antitrust activity. Market share (MKSH) is used as a proxy for market power and was calculated as firm sales divided by total industry sales.[7]

Employee Costs. Costs may be imposed on the firm by the actions of employees or unions. Evidence indicates that union-negotiated wage increases over time are positively associated with accounting earnings [Horwitz and Shabahang, 1971; Tomczyk, 1975]. Benston and Krasney [1978] argue that employee or union demands will be sensitive to fluctuations in earnings; sharp increases may generate demands for wage increases; sharp decreases may impose costs due to fears of financial distress. If employee cost concerns motivate management to reduce earnings fluctuations, one would expect smoothing behavior to be more strongly associated with firms that face strong employee or union groups. The degree of union organization in each firm's industry was used as a surrogate

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insignificant. Use of total assets, equity, or market value is problematic because their values may be altered by the accounting change.

[6] Firm size may be a comprehensive variable and has been used in other studies to proxy for various aspects of the firm. Size could proxy for leverage [Holthausen, 1981; Leftwich, 1981] but the correlation between size and leverage in the sample was −.06, so a relationship is not evident in this study. Size could proxy for information production costs [Firth, 1979] but information production costs should affect whether or not a firm adopts an accounting change, not whether the change, once adopted, has a smoothing effect. Size could proxy for competitive advantage [Belkaoui and Kahl, 1978] but the hypothesis in the body of the paper is consistent with competitive advantage drawing the attention of regulators and motivating smoothing. Size could proxy for management ability and quality of accounting advice [Butters and Niland, 1949]. A positive association between size and smoothing, as hypothesized, could result if all firms attempted to smooth, but because of the uncertainties surrounding the prediction of income, only firms with quality management would succeed. Size also could proxy for informational efficiency. However, if there is more analyst and public attention given to large firms, resulting in more efficient processing of the accounting information of large firms, there would be less rather than more incentive for the management of large firms to use accounting actions to achieve income goals such as smoothing. A negative relationship between size and smoothing would be predicted. Finally, size could proxy for risk/income variability, but another variable in the study provides a control for this factor.

[7] Industry membership was defined by COMPUSTAT four-digit SIC codes for each sample firm. Firms included in an industry were those on COMPUSTAT with the same SIC code.

for union strength. The Bureau of Labor Statistics [1979] provides a classification of industries based on the degree of union organization in the industry. A dichotomous variable (UNPW) is used based on the Bureau's classification of degree of unionization as greater or less than 50 percent. Twenty-six percent of sample firms were in industries where unionization was greater than 50 percent.

Bonus Compensation.[8] Bonus plans may provide for a management compensation committee to award a bonus based on reported earnings. A lower and upper bound between which changes in earnings can affect the bonus award may be specified [Holthausen, 1980; Healy, 1985]. Incentives for management to enhance bonus awards by increasing earnings may vary with the level of income for several reasons: First, if earnings is above the upper bound, an additional earnings increase provides no additional bonus. An earnings decrease may be motivated to use the "saved" earnings in future periods. Second, as income gets higher even within the plan bounds, increasing marginal tax rates and decreasing marginal utility for bonus income may reduce motivation to further increase earnings. Reductions in earnings would be relatively less costly to management when earnings (and bonus) are relatively high. Third, if the compensation committee uses current period income as an evaluative benchmark in exercising its discretion over bonus payments in future periods, management has an incentive to avoid setting a benchmark that will be difficult to achieve in the future. Low income is to be avoided because it depresses the bonus; high income is to be avoided because it raises the standard. The net result of these influences may be the reduction of reported earnings when earnings is high and the enhancement of earnings when earnings is low, i.e., smoothing.[9] A dichotomous variable (BONC) indicating whether or not the firm had a bonus plan in effect at the time of the accounting change is used in the analysis. Information on bonus plans was collected from proxy statements filed with the SEC.

Ownership Control. Concern about evaluation of managerial stewardship may provide incentives to adjust earnings. Unexpected poor performance may increase the probability of salary reduction, firing, or outside takeover. Unexpected good performance may not greatly enhance the probability of job retention for a management team that has been performing at a satisfactory level, but may increase the probability of future performance being poor by comparison [Dhaliwal et al., 1982; Smith, 1976]. Consequently, the disciplining effects of stockholders provide a motivation to smooth performance measures such as earnings. Numerous researchers [Gordon, 1964; Monsen and Downs, 1965; Schiff, 1966; Monsen et al., 1968; Amihud et al., 1974; Smith, 1976] have argued that management sensitivity to the disciplining effects of stockholders will depend on the degree of management's ownership control. Management with small ownership control has greater incentives to adjust performance measures and may be more likely to smooth earnings. An ownership control variable (OWNC) measuring the percentage ownership of the party (director or officer and immediate family) with the single largest block is used in this study.[10]

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[8] Some researchers (e.g., Holthausen [1980]; Watts and Zimmerman [1978]) have suggested that it is relatively easy for compensation committees to adjust bonus payments in response to accounting changes and that there are incentives for the compensation committee to do so. However, Hagerman and Zmijewski [1979] and Zmijewski and Hagerman [1981] have found some association between accounting methods and the existence of bonus plans. In addition, a Peat, Marwick, Mitchell [1977] survey of the effects of FAS #8 found that of 26 companies whose employees' compensation would be altered by the effects of FAS #8, only two companies intended to make changes in salary or bonus arrangements. Thus, there does not seem to be *a priori* reason to assume that bonus compensation is necessarily unaffected by accounting changes.

[9] If reported income both before and after an accounting change is below the minimum bound of the compensation scheme, management has no incentive to adopt an increasing change, as current period compensation is unaffected. But a decreasing change may result in saved earnings to be used in some future period. This suggests a potential incentive to reduce earnings in years of unusually low or negative profits. Such behavior would be consistent with what has been termed the "big bath" [Moore, 1973] and generally inconsistent with smoothing. Healy [1985] hypothesized that the lower bound in bonus plans would encourage bath behavior. Tests on accruals as a discretionary item supported his hypothesis. Tests using accounting changes were inconsistent with his hypothesis. To the extent that bath behavior is motivated by bonus plans, a bias against finding evidence of smoothing associated with bonus plans exists. As a rough attempt to compensate for the effect of big bath behavior, tests were conducted excluding firms (ten) with negative prechange earnings (one can assume they are below the lower bound). Results did not change.

Earnings Variables

Three variables related to earnings are also included in the analysis, both as independent predictor variables and as controls.

Earnings variability and earnings uncertainty. Three arguments that relate smoothing behavior to earnings variability or earnings uncertainty emerge from the smoothing literature. Each rests on assumed links between income fluctuations, risk, and stock price.

The first argument [Ronen and Sadan, 1980, 1981] contends that reported earnings is a signal about future earnings, and that smoothing is a signaling technique. Financial statement users form predictions on the basis of signals provided by management through reported earnings. Smoothing is argued to provide signals that allow for more accurate forecasts, and within the signaling framework, management is assumed to be penalized to the degree that realizations differ from user expectations. Empirically, the unpredictability of earnings has been shown to be associated with market risk measures such as beta and the standard deviation of returns [Givoly and Lakonishok, 1983], so one way management may be penalized is through a higher assessed risk for the firm and a resulting lower stock price.

If this argument is valid, incentives to smooth should increase as the divergence between actual earnings and expectations increases. Consequently, smoothing behavior is hypothesized to be positively associated with the degree to which current earnings (before the accounting change) diverges from expectations. A variable measuring the degree to which prechange earnings deviates from expectations (PED) is included in the study.

The above argument aside, the need or ability to smooth, for whatever reason, may be contingent on the divergence of earnings from expected earnings. In the extreme, if operations as reported by the existing accounting system produces an earnings number that is right "on target," there would be neither need nor ability to use accounting choices to further smooth. Thus, inclusion of PED in the analysis also serves to control for this effect when testing for the relationship between smoothing and the other explanatory variables.

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[10] Ownership percentages ranged from .0001 percent to 56 percent with 12 percent of sample firms above 20 percent and 51 percent below one percent. Since as little as ten to 20 percent ownership is in general sufficient for exercising control [Berle and Means, 1932; U.S. Temporary National Economic Committee, 1940], values of OWNC greater than 20 percent were set equal to 20 percent. This was intended (a) to reduce the influence of the large or outlier values on the analysis, and (b) to make the measure more consistent with some of the categorical measures used in previous accounting change studies (e.g., Smith [1976]). Consideration was given to using the aggregate percentage ownership of directors and officers as a group. Single-party ownership was used to be consistent with previous studies (e.g., Smith [1976]; Dhaliwal et al. [1982]). In this study, single-party and aggregate ownership measures were well correlated (.91), making the issue somewhat moot.

The second argument [Beidleman, 1973; Gordon, 1964] contends that the level of dividends is an important determinant of share value and that investors believe that a stable rather than fluctuating earnings series is capable of supporting a higher level of dividends. Smoothing promotes a stable earnings series which would imply higher dividends and higher share price.

The third argument [Beidleman, 1973] contends that smoothing may reduce the cyclical nature of reported earnings, resulting in reduced covariance of a firm's expected returns with returns in the market, leading to an increase in stock price. This argument for smoothing behavior is implicit in many of the early smoothing studies. It implies a direct, cause-and-effect relationship between earnings fluctuations and market risk (or at least a belief by management in that relationship).[11] Evidence does indicate that market risk measures are associated with accounting measures of income variability [Lev and Kunitzky, 1974] although the evidence does not support the conclusion that the association is direct or cause-and-effect.

If these two arguments are valid, if assessments of future dividends or assessments of risk are affected by fluctuations in accounting earnings, *ceteris paribus*, firms with greater fluctuations in earnings may have greater incentive to smooth. Thus, smoothing is hypothesized to be positively associated with earnings variability. A measure of past earnings variability (VAR), calculated by averaging the deviations of reported earnings from expected earnings in years prior to the year of the accounting change, is used in the study.

The accounting change impact on the level of earnings. Any accounting change that affects earnings must simultaneously alter measures of both the level and the variability of earnings. Assume again that there is a direct relationship (or management believes in a direct relationship) between accounting measures and market parameters. Lower earnings variability then implies lower market risk, but higher reported earnings implies higher accounting returns and higher market returns.[12] Consequently, management should be motivated to use accounting changes both to increase earnings level and to decrease earnings variability. But these co-existing desires may be in conflict.

For example, management cannot simultaneously increase income and smooth income if income is already above expectations. A tradeoff may be required. How might that tradeoff be reflected in accounting change behavior? Assuming the incentives for both higher income and lower variability are valid and that no other incentives are operating, a change that both decreased income and increased income variability would be irrational and should not be observed. If a change that reduced income were observed, one would hypothesize that the change would concurrently smooth earnings. Presumably then, the "cost" associated with reporting reduced earnings would have been offset by a "benefit" gained from lower earnings variability. Alternatively, if a change that increased earnings variability were observed, one would expect that the change would increase earnings. Then the "cost" of higher variability presumably would have been offset by a "benefit" of higher earnings. The incentives for the firm to achieve either of the two desired effects through an accounting change (i.e., either an increase in earnings or a decrease in variability) should be moderated by the degree to which the other effect exists. Observing accounting changes, this implies that to the extent that there is an adverse effect on either income level or income variability, there should be an offsetting and compensating positive effect on the other. If accounting changes are managed in a manner consistent with these incentives, then an inverse relationship between smoothing and the impact of the change on the level of earnings should be observed.

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[11] Admittedly, there has been considerable criticism of the hypothesis that smoothing may be practiced to directly reduce market risk (e.g., Ronen and Sadan [1981]), because in an efficient market the relationship between accounting numbers and market parameters should not be mechanistic and use of visible accounting techniques to affect risk should be ineffective. However, there is reason to at least question both complete market efficiency with respect to accounting methods [Lev and Ohlson, 1982] and, more importantly, management's belief in market efficiency [Mayer-Sommer, 1979]. In addition, one can accept market efficiency and still believe that the processing costs for users to adjust for the effects of accounting techniques exceed perceived benefits, particularly when using a past earnings series to assess risk.

[12] Ball and Brown [1968] and Beaver et al. [1979] provide evidence for an association between the level of reported earnings and market returns.

Variable DIR measures the impact of the accounting change on the level of earnings. DIR is also included as a control, since most previous studies using economic factors similar to those in this study have assumed that the influence of those factors would be reflected in attempts by the firm to adjust the level of earnings [Watts and Zimmerman, 1978; Hagerman and Zmijewski, 1979; Zmijewski and Hagerman, 1981; Bowen et al., 1981; Holthausen, 1980, 1981; Dhaliwal et al., 1982].

Table 2 lists the explanatory variables and their expected association with smoothing behavior.

ANALYSIS AND FINDINGS—FULL SAMPLE

All tests reported are related to one central question: What factors explain variance in the smoothing measure *SB*? Both univariate and multivariate tests were conducted. Univariate tests have the benefit that measurement errors in individual independent variables do not affect results for other variables, while multivariate tests have the benefit that potential interrelations among independent variables are controlled.[13]

Univariate t-Tests

Accounting changes were divided into two groups depending on whether the change smoothed ($SB>0$) or did not smooth ($SB<0$) earnings. The *t*-tests[14] for differences in group means for each of the explanatory variables are reported in Table 3. There are significant results ($\alpha<.10$) for SIZE, BONC, PED, and DIR and each has the predicted sign. Thus, univariate results suggest that smoothing is associated with large firms, firms with bonus plans, firms with a large prechange divergence of earnings from expectations, and firms whose accounting change tended to reduce earnings. Coefficients for variables UNPW, MKSH, OWNC, and VAR are insignificant.

Multivariate Tests—Regression

Multivariate tests were conducted using ordinary least-squares regression with *SB* as the dependent variable. Results (Table 4) for individual variables are consistent with the univariate results; SIZE, BONC, PED, and DIR are signif-

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[13] Correlations between pairs of independent variables were all between −.19 and +.19, with the exception of VAR with PED which was .38.

[14] Use of *t*-tests assumes that observations are drawn from a normal distribution. Some of the variables are dichotomous (UNPW, BONC) and some have a skewed distribution (SIZE, MKSH, OWNC), so normality assumptions are not formally met. Non-parametric tests (Mann-Whitney *U*) were conducted for the continuous variables and *Z*-tests were conducted for the dichotomous variables. Results did not change.

TABLE 2
SUMMARY OF EXPLANATORY VARIABLES

Variable	*Abbreviation*	*Measure*	*Hypothesized Association with SB*
Economic Variables			
Firm Size	SIZE	Total Sales	+
Market Share	MKSH	$\frac{\text{Firm Sales}}{\text{Total Industry Sales}}$	+
Degree of Unionization	UNPW	1 if >50 percent 0 if <50 percent	+
Bonus Compensation	BONC	1 if bonus plan 0 if no bonus plan	+
Ownership Control	OWNC	Percent largest single party stock ownership	–
Earnings Variables			
Prechange Earnings Deviation	PED	$\frac{\lvert PE_\tau - EE_\tau \rvert}{Sales_\tau}$	+
Past Earnings Variability	VAR	$\frac{1}{4}\sum_{k=1}^{4}\left\lvert \frac{RE_{\tau-k} - EE_{\tau-k}}{Sales_{\tau-k}} \right\rvert$	+
Directional Impact of Change on Earnings Level	DIR	$\frac{RE_\tau - PE_\tau}{Sales_\tau}$	–

icant with the hypothesized signs while MKSH, UNPW, OWNC, and VAR are insignificant.

The results reported above indicate a strong relationship between the degree to which preliminary earnings diverge from expectations (PED) and smoothing behavior. In discussing smoothing behavior, Smith [1976, p. 117, citing Cyert and March, 1956, p. 54] has argued that "procedures to create or eliminate profit are undertaken only when the deviation of actual performance from expectations causes management to feel enough pressure." If that is so, then incentives to smooth (for whatever reason) may be contingent on PED, and there may be a different relationship between smoothing and the explanatory variables depending on how much earnings diverges from expectations.

To investigate this idea, sample firms were divided into "high" and "low" prechange earnings deviation groups by splitting the sample at the median PED value.[15] *SB* was then regressed on the independent variables separately for each group. Results are reported in the top and bottom panels of Table 5 for the high and low group, respectively. Three

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[15] In a related test, sample firms were matched on PED values and the differences in *SB* values for the two firms in each matched pair was regressed on the difference in values for each explanatory variable. Findings, though somewhat dependent on how the matching process was undertaken, were consistent with SIZE, BONC, and DIR being the important explanatory variables. In addition, however, there was weak but significant evidence for a positive association between MKSH and smoothing.

TABLE 3
t-TESTS
SMOOTHING MINUS NON-SMOOTHING FIRMS

	Classification from SB			
	Smoothing ($n=137$)	*Non-Smoothing* ($n=75$)		
Variable	*Mean* (*Stnd. Dev.*)	*Mean* (*Stnd. Dev.*)	*t-Value*	*One-Tailed Significance*
SIZE	4490 (9596)	1363 (1386)	3.72	.001
MKSH	.179 (.192)	.147 (.183)	1.16	.12
UNPW	.263 (.442)	.267 (.445)	−.06	.48
BONC	.825 (.382)	.720 (.452)	1.79	.04
OWNC	4.195 (6.675)	5.360 (7.164)	−1.16	.12
PED	.0150 (.0114)	.0115 (.0118)	2.11	.04
VAR	.0092 (.0063)	.0102 (.0060)	−1.13	.13
DIR	−.0022 (.0040)	−.0004 (.0040)	−3.20	.002

TABLE 4
REGRESSION ANALYSIS—FULL SAMPLE

Dependent Variable: *SB*

Explanatory Variables	*Coefficient*	*Standard Error*	*t-Value*
SIZE	4.0×10^{-8}	3.0×10^{-8}	1.38*
MKSH	.00137	.00122	1.12
UNPW	.00014	.00054	.27
BONC	.00058	.00029	1.97**
OWNC	.00020	.00003	.47
PED	.00524	.02213	2.50***
VAR	−.03643	.04160	−.88
DIR	−.30145	.05818	−5.18***
INTERCEPT	−.00050		

$R^2 = .209$
$F = 6.47$
Significance level = .0001

One-tailed significance levels: .10*/.05**/.01***

TABLE 5

REGRESSION ANALYSIS—SPLIT ON PED

Explanatory Variables	*Coefficient*	*Standard Error*	*t-Value*
PED HIGH (ABOVE MEDIAN)			
Dependent Variable: *SB*			
SIZE	3.3×10^{-8}	2.1×10^{-8}	1.55*
MKSH	.00160	.00168	.95
UNPW	.00036	.00085	.42
BONC	.00145	.00069	2.11**
OWNC	−.00001	.00006	−.21
PED	.00189	.00171	1.11
VAR	.02389	.03625	−.66
DIR	−.32188	.14760	−2.18**
INTERCEPT	−.00065		
$R^2=$ .260			
$F=4.09$			
Significance level = .0003			
PED LOW (BELOW MEDIAN)			
Dependent Variable: *SB*			
SIZE	2.2×10^{-8}	5.2×10^{-8}	.42
MKSH	.00009	.00091	.10
UNPW	−.00014	.00056	−.25
BONC	.00018	.00051	.35
OWNC	.00002	.00004	.45
PED	.00899	.00652	1.38*
VAR	−.06389	.06151	−1.04
DIR	−.13233	.08269	−1.60*
INTERCEPT	.00022		
$R^2=$ .145			
$F=1.95$			
Significance level = .062			

One-tailed significance levels: .10*/.05**/.01***

observations are of note. First, the same four variables that were significant in previous tests, SIZE, BONC, PED, and DIR, are significant with the hypothesized signs in one or both of the split-sample regressions. Second, PED is only significant in one of the two regressions. This is not surprising. Since the sample was split on PED, the variance remaining for PED within each subsample has been reduced. Third, both SIZE and BONC are significant only in the high-deviation sample. This is consistent with Smith's claim. The results suggest that larger deviations from expectations may be necessary to trigger the political cost or bonus plan motivations to smooth, and provide confirming evidence for the political cost and bonus plan smoothing hypotheses, since one would expect a stronger association in the high-deviation sample where incentives to smooth would be greater.

TABLE 6
COMPARISON OF GROUP MEANS OF EXPLANATORY VARIABLES
t-TESTS

	Number of Observations		*t-Values*					
Subsample	*Smoothing*	*Non-Smoothing*	*SIZE*	*MKSH*	*BONC*	*PED*	*VAR*	*DIR*
LIFO	72	26	3.00***	.32	1.57*	1.11	−1.21	−1.71**
PENSION	34	25	1.63*	.87	1.28	1.15	−1.19	−1.43*
MIXED	21	19	1.75**	.22	.13	2.31**	1.18	−1.22

One-tailed significance levels: *.10/**.05/***.01

ANALYSIS AND FINDINGS BY ACCOUNTING CHANGE TYPE

From a smoothing standpoint, all of the discretionary accounting changes studied have the necessary quality of altering reported income, so the analysis so far has aggregated all accounting changes into one sample.[16] Clearly, however, specific types of changes have different consequences, particularly with respect to cash flow.[17] In this section, accounting changes are divided into subsamples by type. The 212-sample accounting change events were divided into three subsamples.[18]

1. LIFO Subsample (98 events): Adoptions or extensions of the use of LIFO.
2. Pension Subsample (59 events): Changes in actuarial assumptions (53) and changes in actuarial cost methods (six), which result in changes in normal service cost and pension expense associated with defined-benefit pension plans.[19]
3. Mixed Subsample (40 events): All other accounting change events.

The subsample analysis relies in part on the previous findings. Throughout the full-sample tests, variables UNPW and OWNC were found to be unrelated to smoothing. Consequently, they are deleted from the subsample analysis reported here.[20] Regressions and *t*-tests analogous to those reported for the full sample were conducted for each subsample.

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[16] Aggregating different change types is also consistent with the idea [Zmijewski and Hagerman, 1981] that management uses all techniques within its portfolio of accounting choices to achieve an income strategy.

[17] Some changes may have direct cash-flow consequences; others do not. Some may have cash-flow and earnings effects that coincide; for example, changes in the determination of pension expense. Since ERISA and federal law generally require the funding of normal service cost in the year it is recognized, higher pension expense implies both lower earnings and lower net cash flow. Some changes may have cash-flow and earnings effects that are opposite—for example, changes to LIFO that reduce earnings but increase net cash-flow due to tax savings.

[18] The full sample included 15 events where firms adopted more than one accounting change in a given year. These 15 events were deleted from the subsample analysis.

[19] The full sample included two changes in the amortization period for prior service costs. These two events were included in the mixed subsample.

[20] Both *t*-tests and regressions were conducted including UNPW and OWNC. Throughout all tests across all subsamples, OWNC was insignificant. UNPW was insignificant in all *t*-tests and all regressions except in the LIFO regression where UNPW was significantly positively associated with *SB*. MKSH was also insignificant in the full-sample tests reported in the paper, but was included in the subsample tests because of the possibility, noted in footnote 15, that *SB* might be associated with MKSH.

t-tests

The overall pattern of *t*-test results (Table 6) is consistent with previous findings. SIZE, BONC, PED, and DIR have the hypothesized sign across all three subsamples. There are significant results for SIZE in all three subsamples, for DIR in two of the three, and for BONC and PED in one. These same four variables were the most useful in explaining *SB* in the full-sample tests.

Regression

Regression results are presented in Table 7. SIZE has the hypothesized positive sign in all six regressions but is significant in none. This contrasts with the *t*-test results. SIZE was also significant in the full-sample *t*-tests but significance decreased in the full-sample regressions when other variables were included. In general then, while smoothing may be associated with larger firms, the strength of the association is reduced when other variables are controlled.

The opposite occurs for MKSH. The subsample *t*-test results were insignificant, but with other variables controlled in the regressions, there is some evidence of a significant positive relationship between MKSH and smoothing in both the LIFO and pension subsamples.

Across the three subsamples, R^2 and *F*-values decline as sample size decreases, with the LIFO regressions being most significant. Within the LIFO subsample BONC, PED, and DIR each is significant with the hypothesized sign. VAR is also significant (for the first time in the study) with a negative sign. This is the opposite from the hypothesized positive sign but consistent with the negative signs in all previous tests.

The insignificant findings[21] in the pension and mixed subsamples are perhaps explainable. The *t*-tests for difference in absolute magnitude of the dollar impact on the accounting change on earnings (adjusted for firm size) between the three groups reveal that the changes in the pension and mixed subsamples are of significantly ($\alpha < .001$) smaller magnitude than the LIFO changes. It is possible that when the dollar effects of changes are small, the effect of a change on the earnings series is of minor importance and hence less concern for smoothing is exhibited.

Further Investigation of the LIFO Change

Because of the larger sample size, the larger earnings impact, and the stronger findings in the tests just reported, additional tests were conducted on the LIFO subsample. The LIFO subsample is unique in that almost all changes (95 of the 98) involve a reduction of earnings. Focusing only on the 95 earnings reduction observations permits two additional tests.

First, the 95 firms were divided into two groups depending on whether prechange earnings was above ($n=73$) or below ($n=22$) expected earnings. The magnitude of the earnings reduction from the LIFO switch, deflated by firm size, was determined for each firm. The *t*-test results (significant at .001) indicate that larger eanings reductions occur for firms with prechange earnings above expectations as compared to those with prechange earnings below expectations.

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[21] Using the consensus model for expected earnings (see footnote 3), subsample *t*-tests revealed significant results ($\alpha < .10$) for SIZE, BONC, PED, and VAR; subsample regressions revealed significant results for MKSH, BONC, and PED in one or both of the non-LIFO subsamples. Thus, for this definition of expected earnings, associations between smoothing behavior and the explanatory variables that were exhibited in the full sample were evident for non-LIFO accounting changes as well.

Table 7

Subsample Tests—Regression
(Independent Variable: *SB*)

		Explanatory Variables							
Subsample	*INTERCEPT*	*SIZE*	*MKSH*	*BONC*	*PED*	*VAR*	*DIR*	R^2	F (α)
LIFO[1]	−.0016	2.1×10^{-8} (3.5×10^{-8}) .61	.0022 (.0016) 1.35*	.0014 (.0008) 1.74**	.0646 (.0370) 1.75**	−.0943 (.0616) −.153*	−.5806 (.1121) −5.18***	.35	7.93 (.001)
PENSION	−.0010	8.4×10^{-8} (6.7×10^{-8}) 1.25	.0026 (.0009) 2.80***	.0006 (.0005) 1.29	.0200 (.0179) 1.22	−.0287 (.0323) −.89	.0716 (.1375) .52	.20	2.12 (.067)
MIXED	−.0016	6.5×10^{-8} (7.5×10^{-8}) .86	−.0035 (.0044) −.80	.0003 (.0018) .15	.0578 (.0588) .98	.0244 (.1140) .21	−.1184 (.1557) −.76	.12	.714 (.641)

[1] First line is the coefficient estimate, the second is its standard error, and the third its *t*-value.
(One-tailed significance level: *.10/**.05/***.01)

This result is consistent with a preference for adjusting toward rather than away from expectation.

Second, the magnitude of the earnings reduction was correlated with a measure of the degree to which earnings exceeded expectations (i.e., "unexpected earnings," calculated as $PE-EE$, deflated for firm size). The partial correlation between the earnings reduction and unexpected earnings, controlling for the other explanatory variables, was determined. Results ($R^2=.41$, significant at .001) indicate that the earnings impact increases with the magnitude of unexpected earnings. This is consistent with larger deviations motivating larger downward adjustments.[22] Both of these findings, larger earnings reductions when earnings are above expectations rather than below and larger reductions depending on the degree to which earnings exceeds expectations, are indicative of smoothing behavior.

CONCLUSION

The purpose of this study was to examine the association between income smoothing and factors hypothesized to motivate it. Non-mandatory accounting changes were selected as a smoothing device because they provide an observable action in which an accounting choice alters earnings. Measures used as proxies for incentives to smooth were similar to those used in related studies. Various tests were conducted to determine if smoothing behavior was associated with the hypothesized explanatory factors. Tests on the full sample consistently showed significant associations between smoothing behavior and SIZE, BONC, PED, and DIR. Subsample tests provided some additional confirmation of these associations, although results were not consistently significant across all subsamples.

While several previous studies have indicated that bonus plans provide incentives to adjust the level of earnings, the evidence here suggests that bonus plans also may provide incentives to avoid fluctuations in earnings. The political cost factors in this study, firm size and market share, were both found in some tests to be associated with smoothing. However, findings for market share were weak. Measures such as firm size and market share perhaps are poor surrogates for exposure to political costs. No association between smoothing and union organization or management's stock ownership was found.

The strong relationship between smoothing and prechange earnings deviation suggests that attempts to smooth earnings are triggered by earnings realizations that differ greatly from expectations. This is corroborated by the fact that the association of smoothing with BONC and SIZE was stronger when deviations from expectations were large.

The inverse relationship between

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[22] It could be argued that the correlation between the degree of unexpected earnings and the magnitude of the LIFO switch earnings reduction is due to inflation-caused inventory holding gains rather than to smoothing intent. *Ceteris paribus*, higher inflation could result in larger holding gains which could be reflected in the level of prechange (FIFO) earnings (and therefore in unexpected earnings). Larger holding gains could also imply a larger earnings reduction from the LIFO switch. Thus, the correlation between unexpected earnings and the LIFO earnings impact could result from the association of both with inflation and holding gains.

A further test was conducted to address this possibility. The magnitude of holding gains for a given firm should be related to two items: the magnitude of the firm's inventory and the rate of inflation experienced by the firm. Measures of inventory magnitude (INV) and firm-specific inflation (INFL) were developed. (Procedures analogous to Biddle [1981] were used to develop INFL.) The partial correlation between unexpected earnings and the LIFO switch earnings reduction was determined controlling additionally for INV and INFL, thus controlling for holding gains. Results (partial $R^2=.34$, significant at .001) did not differ materially from that reported in the text. In short, after an attempt to control for a "natural" relationship driven by holding gains, continuing evidence consistent with smoothing remained.

smoothing and the directional impact of accounting changes on the level of reported earnings (DIR) indicates that management may be concerned with the joint effect of its choices on both earnings-based measures of variability and earnings-based measures of performance. This suggests that management may make trade-offs between the risk and return aspects of the firm's earnings numbers when adopting accounting changes.

Conclusions must be tempered by two limitations. First, smoothing was measured using a one-period model. While this is consistent with the operationalization of smoothing in many previous studies, the multiperiod smoothing effect of accounting changes remains untested. Second, while the independent variables were consistent with measures used in previous economic consequences studies, the variables are imprecise proxies for the underlying constructs. Despite these limitations, the results have implications for understanding accounting choices and for future research. First, smoothing may be a contingent phenomenon. Future studies of smoothing may benefit from factoring specific incentives to smooth into research designs. Second, previous studies that have investigated the role of various factors such as political costs and compensation arrangements on accounting choices—and that assumed such factors would cause accounting choices to be used to adjust the level of reported earnings—while valid, may be limited. Management may make choices considering the joint impact on earnings level and earnings variability.

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NOTES

The Effects of the *Thor Power Tool* Decision on the LIFO/FIFO Choice

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ABSTRACT: This note examines the extent to which firms affected by a change in the tax law respond by making changes in the accounting methods used for financial reporting. The specific tax issue considered is the *Thor Power Tool* case that limited the use of formula write-downs for inventories. Since LIFO could be approximated by formula write-downs, we hypothesize that affected firms will tend to switch to LIFO during 1979 (and only during 1979) for tax reporting purposes and (because of the LIFO conformity rule) for financial reporting purposes as well. The empirical analyses of inventory method changes are consistent with this hypothesis.

THIS note examines firms' responses to a change in the tax law which resulted from the Supreme Court's decision in the case of *Thor Power Tool Company v. Comm.* (99 SCt 773, 79-1 USTC Para. 9139). Although the decision involved two issues, the one of interest for this study involves the implementation of the lower-of-cost or market (LCM) method of accounting for inventories for tax purposes.[1] The decision, rendered unanimously on January 16, 1979, prohibited the use of estimates or "formula write-downs" in determining market values of year-end inventories and required firms to use a market value that coincided with "*bona fide* selling prices."

The type of firm affected by *Thor* typically faces a decline in the value of finished goods and/or spare part inventories through obsolescence. Examples of such firms include book publishers and manufacturers of machinery, power tools, and small appliances that have frequent model changes. If these same firms also face an increase in raw material and production costs, they could have, before *Thor*, mitigated the effects of inflation by choosing either LIFO or LCM with formula write-downs.

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[1] The second issue concerned the reasonableness of the allowance for doubtful accounts.

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The decision led tax practitioners to recommend tax planning procedures that might ameliorate the effects of *Thor* for firms that had been using formula write-downs in determining market value. One of the recommendations stated that taxpayers "who are now faced with probable disallowances will probably wish to consider the use of LIFO" [DeLeoleos, 1979, p. 136]. In this note, we test empirically whether, in fact, firms that were likely to be affected by *Thor* were more likely to switch to LIFO than those unlikely to be affected during 1979, the effective year of the decision.

Formally, we test the null hypothesis that the likelihood of a firm switching to LIFO at the time *Thor* became effective is *not* associated with the classification of that firm as being affected by the *Thor* decision. Based on the classification scheme described below, we are able to reject the hypothesis of independence at the five percent level. In addition, we are unable to reject the hypothesis of independence for any other year in the period 1969 through 1980.

In the next section, we describe our method of classifying firms into the "affected" (by the decision) and unaffected groups. We also present the test results. Since our classification scheme is *ad hoc*, we performed additional tests to check the reasonableness of our classification method. The results of these additional tests are discussed in the second section. The final section contains our conclusions.

THE CLASSIFICATION OF FIRMS AND TEST RESULTS

To conduct the empirical analysis, we first had to classify firms into groups of firms that are likely to be affected by *Thor* and those that are not. The "affected" group should be composed of all firms that made use of formula write-downs prior to *Thor*. Unfortunately, this information is not publicly available.[2] Accordingly, we searched all manufacturing industries with an SIC code from 3000 to 3999 (i.e., the manufacturing industries) for those industries that, based on the COMPUSTAT industry description, appeared likely to manufacture a significant number of spare parts. The restriction to manufacturing industries was imposed to provide some level of homogeneity between the affected and unaffected groups while still covering those industries for which inventories are significant. The criteria used to assign an industry to the affected group were that the primary product manufactured by its component firms be: (1) durable; (2) assembled from component parts; and, (3) subject to periodic "model" changes. Based on these criteria, the following industries were assigned to the affected group:[3]

SIC 3510 Engines and Turbines;
SIC 3520 Farm and Garden Machinery and Equipment;
SIC 3531 Construction Machinery and Equipment;

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[2] The taxpayer records are confidential and in their financial reports, firms typically appeal to matching arguments when justifying a switch from FIFO to LIFO.

[3] There is some anecdotal evidence to support including SIC code 3520 in the affected group. In an interview in *Barron's* (April 11, 1983, p. 24), Assistant Secretary of the Treasury for Tax Policy, John E. Chapoton, stated:

> Those who object to that [*Thor*] decision are proposing legislation to overturn it. The book publishing and farm implement industries are two of the major proponents of such legislation. They're suggesting you should be able to write-down and deduct decreases in the value of inventory even though it isn't offered for sale at the decreased price and is still held for sale at the higher price.

Chapoton also discusses book publishing, but a discussion with an officer of the American Association of Publishers revealed that the *Thor* decision affected only publishers of books that have only one printing and are not updated. The affected publishers appear to be primarily smaller firms or privately-held firms. Such firms are not typically included in COMPUSTAT.

SIC 3570 Office Computing and Accounting Machinery;
SIC 3630 Household Appliances;
SIC 3714 Motor Vehicle Parts and Accessories.

In selecting the unaffected group, those manufacturing industries for which it appeared probable that *Thor* would not be a factor were selected. This included all industries with an SIC code of 3000–3499 (inclusive) and 3900–3999 with the exception of 3390 (Miscellaneous Primary Metal Parts), 3430 (Heating Equipment and Plumbing Fixtures), 3449 (Miscellaneous Metal Work), and 3480 (Ordinance and Accessories).

The empirical analyses in this study use data from COMPUSTAT. COMPUSTAT classifies a firm's inventory method into one of seven categories. For our purposes, any method other than LIFO (e.g., FIFO, weighted-average, etc.) was considered to be an LCM method and, therefore, we refer to all of these as "non-LIFO." COMPUSTAT shows codes for each method used by the firm. We took the first number shown as the primary method and classified firms according to this first code. In conducting the tests of the hypothesis, we restricted the affected and unaffected groups to those firms that used a non-LIFO method continuously for at least ten years prior to the final *Thor* decision.

Restrictions on the use of formula write-downs that resulted from the *Thor* decision became effective under Rev. Proc. 80-5 (1980-1 CB 582) for firms with fiscal years ending after December 25, 1979. Thus, for firms with fiscal years ending during calendar year 1979, but before December 25, the inventory method would not have to be changed until their fiscal year 1980 tax returns were filed. For the purpose of this study, a firm was considered to have switched methods as a result of *Thor* if there was a change of method indicated on the COMPUSTAT tape for fiscal year 1979 for those firms with a fiscal year ending in December or if there was a change in fiscal year 1980 for all other firms.[4] This classification scheme gave us a group of 33 affected firms and a group of 113 unaffected firms. Descriptive data on the affected and unaffected industries is provided in Panel A of Table 1. Eight affected group firms and 12 unaffected group firms switched to LIFO during this period as summarized in Panel B of Table 1.

We are interested in whether the switch to LIFO is associated with the classification of industries into affected and unaffected groups. An appropriate statistical test of this hypothesis is Fisher's Exact Test [Brownlee, 1965, pp. 163–165]. We use the exact test rather than the large sample test to avoid problems with small cell sizes. For the data in Panel B of Table 1, the probability of observing the pattern of switches that occurred given the null hypothesis of no association between switches and industry classification is 0.048. Furthermore, the association is in the direction consistent with *Thor* having the hypothesized effect. This result is consistent with the hypothesis that firms react to mandated changes in the tax laws by making other reporting changes in an attempt to par-

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[4] COMPUSTAT defines 1979 to include year-ends from June 1, 1979 to May 31, 1980. A firm was considered to have switched methods, therefore, either if it switched in COMPUSTAT year 1979 and had a fiscal year ending in January through May (inclusive) or December, or if it switched in COMPUSTAT year 1980 and had a fiscal year ending in June through November (inclusive). Thus, in the text, 1979 refers to the period December 1, 1979 to November 30, 1980. Since COMPUSTAT does not report the *day* on which the fiscal year ends and because most firms with December fiscal years are calendar-year firms, we assume that *Thor* will be effective for all firms with December fiscal years in 1979.

TABLE 1

LIFO SWITCHES FROM DECEMBER 1, 1979 THROUGH NOVEMBER 30, 1980 FOR FIRMS USING NON-LIFO IN THE PREVIOUS YEAR

SIC Code	*Total Firms*	*Excluded*	*1979 Switches*	*Net Firms*
Panel A. Industry Data				
Affected Industries				
3510	5	4	1	1
3520	7	3	1	4
3531	6	2	2	4
3570	7	2	1	5
3630	12	8	0	4
3714	25	10	3	15
Totals	62	29	8	33
Unaffected Industries				
3000	15	10	0	5
3069	5	5	0	0
3079	22	10	1	12
3140	13	5	2	8
3199	6	0	0	6
3210	2	1	0	1
3221	6	4	0	2
3241	10	5	0	5
3250	1	0	1	1
3269	1	0	1	1
3270	8	2	1	6
3290	5	4	1	1
3310	42	31	1	11
3320	3	2	0	1
3330	6	3	1	3
3341	3	2	0	1
3350	13	9	0	4
3410	8	6	0	2
3429	13	6	1	7
3452	9	7	0	2
3494	9	6	0	3
3499	16	8	0	8
3911	4	2	1	2
3914	4	1	1	3
3931	3	1	0	2
3940	14	8	0	6
3950	2	1	0	1
3990	10	1	0	9
Totals	253	140	12	113

tially offset the effects of the new rule.

Since switches to LIFO seem to occur more frequently in certain years, we conducted a test of the hypothesis of no association between group assignment and switches to LIFO over the 12-year period 1969–1980. Although the test was basically the same as the test described

TABLE 1—*Continued*

Panel B. Contingency Table For Classification and Change in Method

LIFO Switches During 1979 for Firms Using a Non-LIFO Method in 1978

	Switches	*non-Switches*	*TOTAL*
Affected	8	25	33
Unaffected	12	101	113
Totals	20	126	146

above, the affected and unaffected groups were made up of firms that used a non-LIFO method in the *previous* year. (Recall that in the test described above, we restricted the test to firms that had used FIFO for the *ten* years prior to the *Thor* decision.) If the switching behavior of the affected firms is related to *Thor*, there should be no association between classification of a firm as being affected by *Thor* and its switching behavior relative to the unaffected firms in other years.

Results of these tests are shown in Table 2. Note that the year in which the difference in switching behavior is most significant is 1979. In 1973 and 1974, when the significance levels approach ten percent, it is the unaffected firms that were more likely to switch. In addition, note that the test results are insignificant in 1978 and 1980. If there was some factor that was causing a gradual change in the adoption of LIFO, we would expect to see some evidence of such a trend in the years immediately preceding or succeeding the test year.

TESTS OF THE CLASSIFICATION SCHEME

Since there are no observable characteristics that can be used to assign industries (firms) to the affected and unaffected groups unambiguously, we conducted two additional tests to help determine the extent to which the rejection of the null hypothesis was affected by the choice of the affected and unaffected firms. A potential problem with the statistical analysis is that, of the eight firms that switched to LIFO in the affected group, three were from SIC code 3714 (Motor Vehicle Parts and Accessories). If this industry was excluded from the test (i.e., not included in either the affected or unaffected groups), the probability of the resulting table (z) would be 5.9 percent. Thus, the results of the test do not depend on the most extreme industry.

A second test considered whether differential price changes across industries might explain differences in switching behavior. That is, if prices were increasing in the affected industries at a faster rate than in the unaffected industries in the period around 1979, then the affected firms may have switched to LIFO with greater relative frequency to obtain the benefits associated with writing off the later (higher) costs of production. To test for this, we used data from the Bureau of Labor Statistics on inflation in different commodity groups where the groups were chosen to match, as closely as possible, the SIC codes used in the study. The groups chosen were based on

TABLE 2
LIFO SWITCHES FOR FIRMS USING NON-LIFO IN THE PREVIOUS YEAR
(1969–1980)

	No. Firms		*No. Switched*		*Percent Switched*		
Year[1]	*Affected*	*Unaffected*	*Affected*	*Unaffected*	*Affected*	*Unaffected*	*Prob.*[2]
1969	45	158	0	1	0.0	0.63	0.77
1970	49	173	0	0	0.0	0.0	1.0
1971	51	193	0	1	0.0	0.52	0.791
1972	52	197	0	1	0.0	0.51	0.791
1973	55	202	2	19	3.64	9.41	0.131
1974	54	186	13	60	24.07	32.26	0.163
1975	41	131	1	2	2.44	1.53	0.561
1976	41	135	2	5	4.88	3.70	0.515
1977	38	133	2	9	5.26	6.77	0.542
1978	36	134	3	8	8.33	5.97	0.423
1979	33	129	8	15	24.24	11.63	0.063[3]
1980	27	124	3	21	11.11	16.94	0.336

[1] "Year" refers to the period December 1 through November 30 as discussed in the text.

[2] The probability that the switching behavior is *not* associated with the assignment to groups.

[3] The reason for the difference in the significance level reported here and the 4.8 percent level reported above is the difference in the classification of firms into groups due to the length of time a firm had to have used a non-LIFO method to be included in the test.

the matching by Biddle [1980, Table 4]. Average index levels for 1977–80 are shown in Table 3. The inflation rate for each industry was calculated from these yearly average index levels. Based on a Wilcoxon Rank-Sum test [Lehmann, 1975], inflation was significantly *lower* in the affected industries in 1978 and 1979 and not significantly different in 1980. Thus, the differences in switching behavior do not appear to be associated with price level changes in the way theory would suggest.

SUMMARY

In this note, we have presented the results of a test of the hypothesis that firms react to changes in the tax law by other changes in the way in which economic events are reported. Our results are consistent with this hypothesis. While our classification of affected firms is necessarily judgmental, we conduct additional tests to increase our confidence in the results. These tests rule out some competing hypotheses for the observed difference between the groups in 1979. Since this is the only year when the two groups exhibit significantly different switching behavior, the difference is not a systematic pattern through time. The observed difference is neither driven by the most extreme industry (3714) nor is it attributable to differential changes in price levels during the period *Thor* should have an effect.

It is not surprising that firms change their reporting practices when there are benefits (reduced taxes) to doing so. However, in this paper, we are able to identify changes in the tax law which affect such benefits along with a simple categorization of firms likely to be affected. We observe switching behavior that is consistent with our hypothesis for the year of the tax law change and only the year of the change. Perhaps more important is the indirect evidence that

TABLE 3
WHOLESALE PRICE INDEXES
SELECTED INDUSTRIES
1977–1980

COMPUSTAT SIC	*WPI Group*	*1977*	*1978*	*1979*	*1980*
Affected Industries:					
3510	119401	207.7	215.2	257.9	291.9
3531	112	213.5	232.9	256.2	289.4
3570	119301	95.6	95.9	94.0	90.1
3630	124	145.1	153.0	160.9	174.2
3714	141	163.7	176.0	190.5	208.8
Unaffected Industries:					
3069	071	173.7	185.3	209.2	237.5
3140	043	168.7	183.0	218.8	233.1
3210	1311	160.8	172.8	183.9	196.5
3241	132	199.0	217.7	244.0	274.0
3250	134	179.8	197.2	217.9	231.5
3310	101	230.4	253.6	283.5	305.2
3330	1022	206.0	218.3	295.4	377.2
3341	1024	199.8	212.0	275.4	295.4
3452	104	185.4	200.4	218.7	240.5
3499	107	206.7	226.4	248.9	270.5
3950	119307	164.8	173.6	187.1	211.0
Significance of Differences: (Wilcoxon Rank-Sum Test)			.056	.035	.591

Source: U.S. Department of Labor, Bureau of Labor Statistics.
Annual Average of Producer Price Indexes for Commodity Groups, Subgroups, Product Classes, and Individual Items. Various Years.

the incentives in the tax law are complex. Academic research has not yet fully explained why many firms do not use LIFO. Our research is consistent with the notion that, prior to *Thor*, LCM applied under FIFO may have given tax results comparable to those available under LIFO.

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FINANCIAL REPORTING

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Safe Harbor or Muddy Waters

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ABSTRACT: In 1981, Congress enacted a "safe harbor" lease law that permitted firms to sell unneeded tax depreciation deductions and tax credits to other firms. During the effective life of the law, the Financial Accounting Standards Board (FASB) did not establish reporting or disclosure requirements for firms entering the safe harbor transactions. Because of this, many policies were followed. This paper examines the impact of this lack of reporting and disclosure guidance on the comparability and interpretability of financial statements across firms involved in leasing. This study provides examples of problems the FASB might need to address when analyzing changes under the new tax bill.

IN August 1981, Congress enacted the Economic Recovery Tax Act of 1981.[1] The bill included large personal income tax cuts and a radical shortening of the useful lives of depreciable assets. Since Congress realized firms with tax losses would not benefit from the shortened asset lives, it also included in the bill a "safe harbor" lease law that permitted firms to "sell" to other firms tax depreciation deductions and tax credits on equipment purchased by the loss firms after January 1, 1981. The controversial lease provision was repealed in 1982 amidst concerns about both its effectiveness as a spur to capital investment and its cost to the Treasury.

While transactions under the law were treated as leases for tax purposes, they were reported on financial statements as sales of tax benefits. The impact of the transactions on firms' financial statements is interesting for three reasons. First, the transactions were very significant. For a sample of 96 selling and 125 buying firms from the NYSE and ASE, the cash downpayment alone averaged over $40 million, approximately four percent of net sales of the average firm in the sample.[2] Second, during the effective

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[1] For further explanation, see *Economic Recovery Tax Act of 1981*, Standard Federal Tax Reports, Vol. 69, No. 3 (Chicago: Commerce Clearing House, Inc., January 18, 1982).

[2] The sample of firms was selected using the NAARS option of LEXIS. NAARS is an on-line computer listing

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life of the law there were no binding FASB guidelines for reporting the transactions. Finally, some firms entered into the transactions through wholly-owned subsidiaries whose results were reported separately for financial reporting purposes and consolidated for federal income tax purposes, thereby clouding the interpretability of the law's impact.

Stickney, Weil, and Wolfson [1983] addressed this last issue in examining the impact of the safe harbor leasing law on General Electric's 1981 financial statements. This study builds upon theirs by examining the overall area of safe harbor leasing and financial reporting in some depth. The tax consequences and financial reporting choices are analyzed. Then, the implications of two FASB exposure drafts on the topic are illustrated using a typical safe harbor lease transaction. The potential financial statement effects of the exposure drafts are assessed by employing data from the statements of two selling firms and one buying firm. The FASB's attempt to regulate disclosure with a technical bulletin is evaluated. Finally, the safe harbor leasing episode is summarized and related to issues still existing in the regulated environment of financial reporting.

EXPLANATION OF SAFE HARBOR LEASING

The safe harbor lease law permitted a firm to transfer tax benefits to another firm by "selling" the property and immediately leasing it back. Under the new law, the transaction would transfer the tax benefits associated with the property if three conditions were met: (1) the lessor (buyer) was a corporation, (2) the lessor maintained a ten percent investment in the adjusted basis of the property, and (3) the lease term was restricted in length. If these conditions were met, other considerations such as actual ownership, intent of the parties, and the presence of a bargain purchase element at the end of the lease would be ignored.[3] This permitted the lessor (buying) firms to assume far less risk in obtaining tax benefits than was required under prior law.

TAX TREATMENT

The structure and tax treatment of a safe harbor lease can be illustrated by examining a lease entered into between Chrysler Corporation and General Electric Company (GE) covering approximately $150 million of equipment.[4]

In 1981, Chrysler purchased equipment from a supplier for $26 million cash and a note payable of $124 million. Depreciation expense on the equipment for tax purposes, an amortization schedule for the note, and the tax benefits available to both parties under a safe harbor lease are provided in Table 1. In the absence of a lease contract with GE, Chrysler would make entries related to the equipment purchase on its "tax" books as shown in panel A of Table 2. As shown, Chrysler would receive a tax deduction for the depreciation expense on the equipment and interest expense on the note. In addition, Chrysler would

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of five years of financial statement text for most New York and American Stock Exchange firms in addition to a large number of firms traded over the counter.

[3] By permitting the transaction to be classified as a lease, the desired result of transferring the tax benefits without shifting additional risk to the lessor was achieved. For further explanation, see Internal Revenue Code (IRC) Section 168 (f)(8).

[4] Information concerning the transaction was accumulated from each company's annual report, news releases, and a letter received from Chrysler. Four assumptions are made to facilitate presentation of this example including: (1) a ten-year note with a 12 percent interest rate; (2) a five-year depreciable life on all equipment for tax purposes; (3) a January 1, 1981 transaction date; and (4) a nonrecourse note equal in terms and amount to the original financing by Chrysler. Although all of these assumptions are necessary to provide the example, minor deviations in any of the assumptions would not change the tenor of the results.

TABLE 1

TAX DEPRECIATION EXPENSE AND INTEREST EXPENSE CALCULATIONS FOR CHRYSLER FOR YEARS 1981-1990

(IN MILLIONS)

						Tax Benefits[5]	
Year (*1*)	*Tax Depreciation*[1] (*2*)	*Lease Payments* (*3*)	*Interest*[2] (*4*)	*Principal Payments*[3] (*5*)	*Note Balance*[4] (*6*)	*Seller* (*7*)	*Buyer* (*8*)
Beginning Note Balance					124.00		
1981	22.50	21.95	14.88	7.07	116.93	7.07	15.43[6]
1982	33.00	21.95	14.03	7.92	109.01	7.92	25.08
1983	31.50	21.95	13.08	8.87	100.14	8.87	22.63
1984	31.50	21.95	12.02	9.93	90.21	9.93	21.57
1985	31.50	21.95	10.82	11.13	79.08	11.13	20.37
1986		21.95	9.49	12.46	66.62	12.46	(12.46)
1987		21.95	7.99	13.96	52.66	13.96	(13.96)
1988		21.95	6.32	15.63	37.03	15.63	(15.63)
1989		21.95	4.44	17.51	19.52	17.51	(17.51)
1990		21.95	2.43	19.52	0.0	19.52	(19.52)
TOTALS	150.0	219.50	95.50	124.00		124.00	26.00

[1] Depreciation expense is based on a five-year asset life. Percentages of 15%, 22%, 21%, 21%, and 21% for years 1981-1985 are prescribed by IRC section 168.

[2] Interest rate is assumed to be 12 percent per annum.

[3] This column also represents the net rental income to GECC and the net rental deductions to Chrysler.

[4] Note balance is as of the end of the year.

[5] The benefits shown are available to a firm with taxable income in the current year. Clearly, the seller described herein did not have such positive current taxable income. In addition, the seller receives interest expense deductions equal to column four regardless of whether it enters into a safe harbor lease. Benefits should be multiplied by firm tax rate to obtain actual tax reduction.

[6] Also receives an investment tax credit of $15 million.

receive a $15 million investment tax credit (ten percent of the equipment cost). If Chrysler had to pay tax in 1981, this equipment purchase could have significantly reduced its tax liability. However, since Chrysler had large tax loss carryovers and investment tax credit carryovers in 1981, the new deductions and credits had little value, if any, to Chrysler in 1981.[5]

Chrysler, however, was able to receive an immediate benefit by entering into a safe harbor lease with GE. Chrysler sold the equipment it had just purchased to GECC, a financing subsidiary of GE, for the equipment's $150 million market value. GECC paid $26 million in cash and gave Chrysler a $124 million nonrecourse note. The $26 million payment was the negotiated price for the tax benefits and was equal to the payment made by Chrysler to the supplier. The nonrecourse note was identical in terms to Chrysler's underlying debt.[6] Chrysler

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[5] Chrysler's tax loss and investment tax credit carryovers at December 31, 1980 totaled $1.0 billion and $194 million, respectively. In addition, Chrysler reported a loss of $475.6 million in its 1981 annual report.

[6] Since the lease structure was used solely for the purpose of transferring tax benefits, it was the norm that the lease transaction was identical in amount and terms to the underlying debt. Most often the transactions were entered into simultaneously even though the law allowed a three-month period from the date of the original purchase for completion of the lease agreement.

TABLE 2

1981 TAX RETURN ENTRIES FOR CHRYSLER AND GECC[1]
(IN MILLIONS)

PANEL A
IF FIRMS DO NOT ENTER INTO A LEASE

	Chrysler				*GECC*		
1-1	Equipment	150.00					
	Cash		26.00		No Entries		
	Note Payable		124.00				
12-31	Note Payable	7.07					
	Interest Expense	14.88					
	Cash		21.95				
12-31	Depreciation Expense[2]	22.50					
	Accumulated Depreciation		22.50				

PANEL B
IF FIRMS ENTER INTO A LEASE

	Chrysler				*GECC*		
1-1	Equipment	150.00					
	Cash		26.00				
	Note Payable		124.00				
1-1	Cash	26.00		1-1	Equipment	150.00	
	Note Receivable	124.00			Cash		26.00
	Equipment		150.00		Note Payable		124.00
12-31	Note Payable	7.07					
	Interest Expense	14.88					
	Cash		21.95				
12-31	Rent Expense	21.95		12-31	Note Payable	7.07	
	Interest Income		14.88		Interest Expense	14.88	
	Note Receivable		7.07		Rent Income		21.95
				12-31	Depreciation Expense[2]	22.50	
					Accumulated Depreciation		22.50

[1] Amounts calculated in Table 1.

[2] In addition, the transaction will reduce the tax liability by $15 million for investment tax credit.

then leased the equipment back from GECC for a yearly payment equal to the debt service payment. At the end of the ten-year lease, Chrysler will repurchase the equipment for one dollar. Chrysler will continue to make payment on the original supplier note each year. Since the annual lease payment from Chrysler to GECC is exactly equal to GECC's nonrecourse note payment, no cash will pass between these parties except for the original $26 million downpayment.

Journal entries summarizing the safe harbor lease for both firms are summarized in panel B of Table 2. Chrysler records the sale to GECC by setting up a nonrecourse note receivable. Then at December 31, 1981, Chrysler pays the 1981 installment on the supplier's note, claiming an interest expense deduction of $14.88 million just as it did before. Chrysler does not, however, claim depreciation on the equipment since GECC is considered to own the equipment for tax purposes. Instead, Chrysler takes a $21.95 million rent expense deduction (fourth entry of panel B). It also includes in income an amount equal to the $14.88 million interest deduction claimed by GECC on the nonrecourse note. The rent deduction and interest inclusion are generated by the cancellation of the yearly installments on the nonrecourse note and the corresponding lease payment. The two advantages of the safe harbor lease to Chrysler are: (1) the receipt of the payment from GECC which provides the funds for the down-payment on the equipment; and (2) the deferral of deductions from 1981–85 to later years when the firm might have a greater need for them (see Table 1, column 7).

In contrast, GECC includes as rental income the $21.95 million yearly cancellation of its nonrecourse note by Chrysler with a deduction for the interest implicit in the note (GECC's entry 2 in panel B of Table 2). This entry is a mirror image of the fourth entry for Chrysler in the same panel. This provides a net income inclusion each year for GECC of the principal payments (column 5 of Table 1) during 1981–90. In addition, GECC deducts depreciation on the total equipment cost (column 2 of Table 1) during 1981–85 and receives a $15 million direct reduction of income taxes because of investment tax credit in 1981. These tax benefits will exceed GECC's $26 million investment within the first two years. In addition, GECC benefits from the transaction in its ability to defer taxes from years one to five, when depreciation deductions exceed its income from the note cancellation, to years six to ten, when it still has income from the note cancellation but has no depreciation deductions (see Table 1, column 8). GE benefits from these tax deductions directly because it files a consolidated federal income tax return with GECC.

FINANCIAL REPORTING TREATMENTS

Parties to safe harbor leases had to decide both how to allocate the proceeds to income and how to disclose the significant details of the transactions in their published financial statements. For example, Chrysler chose to report the $26 million cash received from GECC in income. It could have chosen to capitalize the payment, or a portion thereof, as a deferred credit to be amortized into income in future periods. Examination of the earlier mentioned sample of 96 selling firms revealed 69 firms followed Chrysler by reporting the full proceeds in income. The remaining 27 firms capitalized and amortized all, or a portion, of the payment (see Table 3). GECC chose to capitalize the payment as a noncurrent asset which it amortized into income as tax benefits were received. Instead it could have allocated the payment into two amounts, one paid for depreciation deductions and another for investment tax credits. Disclosures by the 125 buying firms in the earlier noted sample were inadequate to determine which of these two methods most firms followed. However, there was evidence from the sample that there was no consistency over whether the asset should be classified as current or noncurrent. Most of the reporting positions taken can be traced to two FASB exposure drafts.

On October 29, 1981, the Financial Accounting Standards Board (FASB) proposed rules for accounting for safe harbor leases by both buyers and sellers. It proposed that the transactions were not subject to FASB Statement No. 13, "Accounting for Leases," but would be

TABLE 3

SUMMARY OF 1981/82 REPORTING POLICIES FOR BUYING AND SELLING FIRMS

PANEL A
125 BUYING FIRMS

Firms Disclosing Dollar Amount of Payment		89
Method of Disclosure		
Statement of Changes in Financial Position	56	
Footnotes	33	
Firms Disclosing Unamortized Balance of Payment in Balance Sheet		60
Current Asset	10	
Noncurrent Asset	45	
Allocation Between Current and Noncurrent Assets	5	
Firms Disclosing Effect on Income Taxes		94

PANEL B
96 SELLING FIRMS

Firms Disclosing Method of Accounting Treatment for Downpayment		96
Accounting Method		
Total Inclusion in Income	69	
Allocation Between ITC and Depreciation	17	
Amortization of Entire Amount	10	
Firms Disclosing the Amount of Payment and Its Effect on Net Income		91
Method of Disclosure		
Special Item	12	
Extraordinary Item	0	
Footnote	79	
Firms Reporting the Effect of the Transaction on Deferred Taxes		78

treated as a sale or purchase of tax benefits.

Under the proposed rules, selling firms would reduce income tax expense for the portion of the payment received applicable to the investment tax credit. The amount of the reduction each year would be determined by the firm's overall accounting method for investment tax credit (ITC), flow-through or deferral. The remaining amount of the payment would reduce the cost of the underlying property and the depreciation subsequently deducted for financial reporting purposes.

The buying firms would record the payment made for the tax benefits in two separate asset accounts, one for the ITC and one for the depreciation deductions. As a firm received tax reductions from the credits and deductions, it would reduce the asset balances.

At its December 16, 1981 meeting, the FASB concluded that the provisions needed to be revised and reexposed. The new exposure draft was issued on April 13, 1982 with several changes in the October position. No allocation was to be made between the amount applicable to ITC and depreciation. For selling firms, the entire amount received was to be included in income with an appropriate provision for deferred taxes. The buying firms would capitalize the entire

TABLE 4

FINANCIAL ACCOUNTING ENTRIES FOR CHRYSLER IN THE FIRST YEAR OF THE LEASE UNDER BOTH EXPOSURE DRAFTS

October Exposure Draft (*1*)			*April Exposure Draft* (2)		
1) *Sale of Tax Benefits* (*1-1-81*)					
Cash	26.00		Cash	26.00	
Deferred Tax Expense[1]	6.90		Deferred Tax Expense[1]	11.96	
Equipment		11.00	Sale of Tax Benefits		26.00
Income Tax Expense		15.00	Deferred Taxes		11.96
Deferred Taxes		6.90			
2) *Year-End Entry* (*12-31-81*)					
Depreciation Expense[2]	13.90		Depreciation Expense[2]	15.00	
Income Taxes Payable[3]	3.25		Income Taxes Payable[3]	3.25	
Deferred Taxes[4]	3.14		Deferred Taxes[4]	3.65	
Accumulated Depreciation		13.90	Accumulated Depreciation		15.00
Income Tax Expense		3.25	Income Tax Expense		3.25
Deferred Tax Expense		3.14	Deferred Tax Expense		3.65

[1] Deferred taxes are calculated at a rate of 46 percent on the difference between the depreciable basis in the assets for financial statements ($139 million in the October draft and $150 million for April) and the net rental expenses deductions to be taken over ten years on the tax return ($124 million). The net rental expense is defined as gross rental expense less interest income from the note cancellation (column five of Table 1).

[2] Asset Cost ÷ Useful Life. Asset useful life is assumed to be ten years for financial reporting purposes.

[3] Reduction in current income taxes each year is equal to the tax rate times the net rental expense deduction.

[4] Deferred taxes are equal to the tax rate·(financial statement depreciation expense − net rental expense deduction).

investment. As tax benefits were received, the buying firm would reduce the asset account balance. Interest income then would be accrued on the account balance each year until there were sufficient tax savings to recover the investment. Subsequently, any excess recovery or investment would be amortized over the remaining life of the lease.

ILLUSTRATION OF ENTRIES MADE UNDER EACH EXPOSURE DRAFT

Differences between the October and April rulings can be illustrated in the context of the Chrysler-GE transaction. Assuming both firms use the flow-through method of accounting for the investment tax credit, the entries that would be made under each ruling by Chrysler and GECC are detailed in Tables 4 and 5, respectively. The entries in Table 4 for Chrysler do not consider the effect of the debt service payments made to the outside supplier since the interest on these payments would be deductible for both tax and financial reporting purposes whether or not Chrysler enters into the lease. The entries are limited to the effect of the sale-leaseback transaction between Chrysler and GE.

As shown in column 1 of Table 4, Chrysler would allocate the cash proceeds between investment tax credits and depreciation under the October exposure draft. The $15 million allocable to investment tax credit would reduce income tax expense and the remaining $11 million received is credited to the equipment account, thereby reducing depreciation expense over the subsequent ten-year period. Deferred taxes would be set up for the tax effect on the difference between the remaining unrecovered asset cost ($139 million), that will be depreciated for book purposes, and the net rental deductions ($124 million), that will be deducted for tax purposes.[7] At year-end, Chrysler would calculate depreciation expense. Income tax expense would be reduced by the net rental expense deduction on the tax return ($7.07 million•.46). Finally, deferred tax expense would be reduced by the excess of the $13.9 million depreciation expense deduction on the financial statements over the $7.07 million net rental expense deduction taken on the tax return times the tax rate.[8]

In contrast, Chrysler would include the entire proceeds in income under the April exposure draft (column 2 of Table 4). Since the $150 million asset cost is not reduced in this case by a portion of the proceeds, deferred taxes must be increased for the tax effect of the excess of the $150 million in depreciation to be received in the next ten years for book purposes over the $124 million in net rental expense deductions on the tax return. The only changes in the year-end entry come directly from the use of the higher depreciation basis in the equipment. Depreciation expense is increased to $15 million per year and the deferred tax effect on the excess of financial statement depreciation expense over tax return deductions is adjusted for the additional $1.1 million per year of depreciation.[9]

The impact of the exposure drafts on the buying firm, GECC, is shown in Table 5. Under the October draft, GECC would divide the total cost between the $15 million paid for the ITC and the $11 million paid for the ACRS deductions.[10] GECC then recovers the cost in the two assets through a procedure detailed in Appendix A. While this procedure is complicated, an attempt at an intuitively understandable explanation follows.

First, GECC calculates the net tax deduction ($26 million) it will receive over the ten-year period. This is the amount by which the tax depreciation exceeds the net rental income. This amount is shown in column 2 of Table A-1. The net deduction is allocated between ITC and depreciation based on the original allocation of $15 million and $11 million, respectively. An additional constraint was added that no allocation would be made to ITC in years in which net rental income exceeds the tax depreciation deductions. These tax deductions, columns 3 and 4 in Table A-1, are multiplied by the tax rate to derive the tax benefits applicable to the two asset accounts. The actual tax reduction in 1981 due to ITC of $15 million is then added to the tax benefit otherwise allocable to the ITC account to get the total benefit allocable to ITC, shown in column 5 of Table A-1.[11] Entry 2 in Table 5, at

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[7] This difference of $15 million is caused by reporting an income to shareholders in 1981 that includes a reduction of income tax expense for book purposes not reported currently for tax purposes. The net rental expense deducted is calculated by subtracting the interest income included on the tax return each year from the total rental expense. This is equivalent to a net deduction each year of the note principal payments. Taxes are calculated at a 46 percent rate throughout this example. The $15 million timing difference is equal to the investment tax credit transferred to GECC. However, it does not follow that Chrysler is receiving benefit from a tax credit and therefore should not accrue deferred taxes. The deferred taxes are created solely because of timing differences in reporting income for book and tax purposes.

[8] For derivation of the $7.07 million net rental expense deduction, see Table 1 and entry 4 in panel B of Table 2.

[9] Note that in each case the total reduction in taxes, current and deferred, is equal to the depreciation expense times the tax rate.

[10] ACRS stands for Accelerated Cost Recovery System, the depreciation system introduced by the Economic Recovery Tax Act of 1981.

[11] Since only $15 million is recovered through ITC, this $21.90 million allocation seems puzzling. The tax deduc-

TABLE 5
FINANCIAL ACCOUNTING ENTRIES FOR GECC IN THE FIRST YEAR OF THE LEASE UNDER BOTH EXPOSURE DRAFTS

October Exposure Draft (*1*)			*April Exposure Draft* (*2*)		
1) *Purchase of Tax Benefits* (*1-1-81*)					
Investment in ITC Tax Benefits	15.00		Investment in Tax Benefits	26.00	
Investment in ACRS Tax Benefits	11.00		Cash		26.00
Cash		26.00			
2) *Year-End Entry* (*12-31-81*)[1]					
Income Taxes Payable	16.01		Income Tax Payable[2] (22.50−7.07).46+15.0	22.10	
Investment in ITC Tax Benefits		11.68	Income Tax Expense		22.10
Gain on Utilization of Tax Benefits		4.33	Deferred Tax Expense	22.10	
			Investment in Tax Benefits		22.10
Income Taxes Payable	6.09		Investment in Tax Benefits[3]	1.68	
Investment in ACRS Tax Benefits		6.09	Investment Income		1.68

[1] See Appendix 1 for calculations.

[2] (Tax Depreciation − Note Principal Payment)• Tax Rate + Investment Tax Credit

[3] (Original Cost)•[(1 − Tax Rate)•Interest Rate]. An interest rate of 12 percent was used and it was assumed that all tax benefits were received at the end of the year for computational ease. If it was assumed that the benefit was received quarterly as tax payments made were reduced, this figure would be slightly lower.

December 31, is then computed by allocating the five-year, $21.90 million in tax benefits attributed to the ITC to the $15 million asset balance (see Table A-2 for further details). The tax benefit allocable to depreciation (entry 3) reduces the investment in ACRS tax benefits on a cost recovery basis. When cumulative tax savings exceed the original investment, the FASB concluded the net benefit from tax deferral should be recognized as an asset and amortized into income on a constant interest rate basis during the period of excess tax savings.

Maybe in part because of the unnecessary complexity of the October draft, the accounting for a buying firm such as GECC was simplified in the April exposure draft. First, GECC would make no allocation, capitalizing the total cost in one account. The income tax payable and income tax expense accounts would each be reduced by the $22.10 million tax benefit from the transaction received in 1981. This is equal to the $15.0 million ITC plus the tax rate times the difference between tax depreciation and net rental income.[12] Concurrently, the investment account would be reduced with a corres-

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tions seem more appropriately allocable to the ACRS deductions. The reasoning behind the FASB position is not clear.

[12] See columns 2 and 5 of Table 1. Depreciation and net rental income in 1981 equalled $22.5 million and $7.07 million, respectively.

ponding debit to deferred tax expense to recognize the recovery of the investment. In years in which the total tax savings exceed the investment, the credit to the investment account would be replaced with a credit to deferred tax payable to recognize the timing difference between tax and books, which will reverse in years six to ten when GECC still has rental income but no longer has depreciation deductions. Finally, interest would be accrued on the asset balance at the firm's after-tax rate (entry 3 in column 2 of Table 5).[13] In later years, when GECC's cumulative tax savings exceed its investment in the tax benefits, it will recognize the excess in income using the "interest" method.[14]

Examples of Reporting Practices

Having presented derived data in respect to one transaction, the study's focus now turns to some examples of actual reporting practices. The reporting practices embraced by sellers are illustrated using data from the 1981 financial statements of two firms.

The first firm, Arizona Public Service Company (APSC), bought equipment valued at $250 million and sold the associated tax benefits to General Electric for $50,625,000 in November 1981. Table 6 provides information summarized from the 1981 annual report, as well as data that would have been shown under alternative accounting methods.

APSC chose to capitalize the entire amount it received and amortize it over the 30-year lease period. As a result, the impact on the current year net income was minimal ($231,000).[15] A summary of the APSC income statement as actually reported is shown in column 1 of Table 6.

Had APSC chosen to follow the October exposure draft, net income would have increased by approximately $13,500,000. The income statement that would have been provided under the terms of the October exposure draft is shown in column 2. The $231,000 amortization deducted in column 1 from income tax expense was not deducted in column 2. Instead, the payment was divided between ITC and depreciation.[16] The $25,625,000 allocated to reduce the asset's basis reduced current year's depreciation by $427,000, and in turn, increased deferred taxes by $196,000 (46 percent of $427,000). Income tax expense was reduced for the $25,000,000 allocated to ITC. A corresponding increase of $11,500,000 in deferred taxes was recorded on this amount.[17]

The income statement that would have been shown if the tax benefits had been reported under the April exposure draft is provided in column 3. Two differences are evident from column 1. First, the $231,000 amortization is added back to income taxes on operations. Second, the $50,625,000 proceeds are included in net other income less deferred taxes of $23,288,000. The use of this alternative method would have increased APSC's reported net income by approximately 14 percent relative to the amount actually shown for the year.

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[13] The after-tax rate to be used for this purpose cannot exceed the lower of the buyer's after-tax incremental borrowing rate or the after-tax rate the buyer could earn on a short-term investment. For purposes of this study, a 12 percent before-tax rate was assumed.

[14] See "Accounting for the Sale or Purchase of Tax Benefits through Tax Leases," Financial Accounting Standards Board, April 13, 1982, pp. 26–27 for an example on future years.

[15] This was disclosed in footnote 8 of the company's 1981 annual report. Income tax expense on operations would have been $231,000 greater without the amortization of the deferred credit.

[16] The method of accounting for and absolute amount of the ITC was disclosed in the financial statements. An asset life of ten years and purchase date of November 1 was assumed for exposition purposes.

[17] As mentioned earlier, the deferred taxes are created since depreciation expense exceeds net rental expense under the lease by the amount allocated to ITC.

TABLE 6
IMPACT OF ALTERNATIVE REPORTING PRACTICES
ARIZONA PUBLIC SERVICES COMPANY (1981)
(IN THOUSANDS)

	Presentation Following		
	Treatment as Deferred Credit (As Reported) (1)	*October Exposure Draft (2)*	*April Exposure Draft (3)*
Operating Revenues	$882,154	$882,154	$882,154
Operating Expenses	608,855	608,428[2]	608,855
Pretax Operating Income	$273,299	$273,726	$273,299
Income Taxes on Operations	22,381[1]	9,308[3]	22,612
Net Income from Operations	$250,918	$264,418	$250,687
Other Income (Expenses)	$(56,227)	$(56,227)	$ (5,602)[4]
Less: Income Taxes (Benefit)	(2,743)	(2,743)	20,545[5]
Net Other Income (Expenses)	$(53,484)	$(53,484)	$(26,147)
Net Income	$197,434	$210,934	$224,540
Earnings Per Share	$ 3.26	$ 3.52	$ 3.78

[1] Reduced by the $231,000 amortization of the deferred tax benefit.

[2] Depreciation expense reduced by $427,000, equal to the amortization of the $25,625,000 allocated as a reduction of the asset depreciable basis over a ten-year life beginning November 1981 (two months amortization in 1981).

[3] Income taxes on operations ($9,308,000) equal taxes without considering the lease ($22,612,000) – [proceeds allocated to investment tax credit ($25,000,000) less deferred taxes on the proceeds (46 percent of $25,000,000)] + deferred taxes on the reduction in depreciation expense (46 percent of 427,000).

[4] Entire $50,625,000 shown as other income.

[5] Deferred taxes computed on the $50,625,000 proceeds at 46 percent.

A second firm, Wheeling-Pittsburgh Steel Corporation (WPSC), chose to follow a method consistent with the terms of the (later released) April exposure draft. WPSC sold tax benefits on $100 to $150 million of new equipment to Batus Inc. for $33.247 million, also in November 1981. WPSC chose to report the entire proceeds in income. After deferred taxes of $7.2 million, the payment increased net income by $26,047,000 or $6.61 per share.[18]

Table 7 provides a set of data similar to that shown in Table 6 for APSC. As shown in column 3, nearly the entire income shown in 1981 was due to safe harbor leasing (a fact mentioned by the company in the management discussion section of its annual report). Treating the payment in a manner similar to APSC, column 1, would have reduced EPS by $6.57 (or 93 percent). Again, the results based on the October draft had a less dramatic impact on income than either of the other methods.

In contrast to these results for selling firms, the reporting choices for buying

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[18] WPSC deferred tax rate of 21.6 percent was lower than the statutory rate primarily because of tax credit carryovers.

TABLE 7
IMPACT OF ALTERNATIVE REPORTING PRACTICES
WHEELING-PITTSBURGH STEEL CORPORATION (1981)
(IN THOUSANDS)

	Presentation Following		
	Treatment as Deferred Credit (1)	*October Exposure Draft (2)*	*April Exposure Draft (As Reported) (3)*
Net Sales	$1,151,112	$1,151,112	$1,151,112
Sale of Tax Benefits			33,247
Other Revenues	20,530	20,530	20,530
Total Revenues	$1,171,642	$1,171,642	$1,204,889
Cost and Expenses	1,166,746	1,166,401[3]	1,166,746
Income Before Taxes	$ 4,896	$ 5,241	$ 38,143
Taxes on Income (Benefit)	(784)[2]	(10,318)[4]	6,600[1]
Net Income	$ 5,680	$ 15,559	$ 31,543
Earnings Per Share	$ 0.46	$ 3.47	$ 7.03

[1] Includes deferred taxes on sale of tax benefits of $7,200,000.

[2] Deleted deferred taxes of $7,200,000 and decreased for amortization of gain of $184,000. Amortization computed based on an assumed 30-year lease and a purchase date of November 1981 (assumptions used in Table 5 by APSC).

[3] Depreciation expense reduced by $345,000, equal to the amortization of the $20,747,000 allocated as a reduction of the asset depreciable basis over a ten-year life beginning November 1981 (two months amortization in 1981).

[4] Tax Benefit from operations (−$10,318,000) equal tax benefit without considering the lease (−$600,000) − [proceeds allocated to investment tax credit ($12,500,000) less deferred taxes on the proceeds ($21.656 percent of 12,500,000)] + deferred taxes on the reduction in depreciation expense (21.656 percent of $345,000).

firms had less dramatic impacts on income. Most firms handled the transactions similarly to Marsh and McLennon, who reported a cash investment of $31,000,000 in November 1981 in various transactions on $140 million worth of equipment. Marsh and McLennon reported reductions of taxes payable of approximately $16 million. The remaining $14,824,000 unrecovered investment was reported in other assets to be recovered in future years as tax benefits were received. Marsh and McLennon reported in a footnote that the transaction had an immaterial impact on income for 1981. Like most buying firms, Marsh and McLennon did not provide sufficient disclosures to determine whether it followed the October or April exposure draft when computing the impact on taxes.

DISCUSSION OF REPORTING AND DISCLOSURE POLICIES

As discussed, the safe harbor leases had a potentially large impact on the financial statements, especially for selling firms. However, the FASB decided in December 1981 that its proposed statement of October 29, 1981 was inadequate and needed to be withdrawn. The FASB was concerned that because of the withdrawal it would not provide reporting guidelines for firms reporting transactions in 1981.[19] Therefore, on January 27, 1982, FASB Technical Bulletin No. 82-1, *Disclosure of the Sale or Purchase of Tax Benefits Through Tax Leases*, was released. The bulletin required disclosures under APB 22 of all significant accounting policies applicable to the tax leases including the method of accounting for the transactions, the method of recognizing income, and the method for allocating asset cost and tax benefits between periods. Also, the transaction's impact on the relationship between income tax expense and pretax accounting income was required to be disclosed as discussed in APB 11. Finally, if the transaction was material and unusual and/or infrequent to the firm, such disclosure was mandated under APB 30.

Sample data reported in panel A of Table 3 suggest that the FASB's concern about the buying firms' disclosures appears warranted. The magnitude of the transactions, with the cash payments alone averaging $42.9 million or 3.9 percent of sales, seemed material enough to require disclosure under APB 22. However, only 89 firms disclosed the cash payment at all. Fifty-six firms presented the outlay in the Statements of Changes in Financial Position and footnotes with the remaining 33 discussing it only in footnotes. In addition, less than one-half, 60 firms, revealed the impact on the balance sheet. Of these, 45 firms disclosed the asset balance as a noncurrent asset, ten as a current asset, and five as an allocation between current and noncurrent. Since most safe harbor lease transactions were of similar structure, these differences are puzzling.

APB 11 requires disclosures of any significant variations in the customary relationships between pretax accounting income and income tax expense. Ninety-four of the 125 firms followed APB 11 by disclosing the impact of safe harbor leasing on taxes paid in 1981 and/or 1982. While these numbers seem encouraging, it should be noted that some of the buying firms with the largest involvement did not disclose the impact. As illustrated by Stickney, Weil, and Wolfson [1983], this seeming noncompliance with APB 11 may be caused by the use of nonconsolidated subsidiaries to make the purchases. However, only two firms mentioned that the effects of the lease transactions were in such subsidiaries.

As shown in panel B of Table 3, disclosure by the 96 selling firms was considerably better, probably because of the potentially substantial impact on income. For these firms, the cash payment averaged $47.1 million or 4.2 percent of net sales. All 96 firms disclosed their method of accounting for the cash downpayment. The majority of selling firms, 69 in total, followed the April exposure draft by reporting the entire cash payment as income. Seventeen other firms reported an allocation of the cash payment received between investment tax credits and depreciation deductions as proposed in the October draft. The remaining ten firms amortized the entire amount over the underlying asset life or lease term.

While disclosure of the accounting methods was adequate, disclosure of the impact on net income was less discernible. Ninety-one of the 96 firms revealed the amount of the cash payment. However, only 12 firms reported the transactions' impact on a separate line item on the income statement. None of the firms reported the income as an extraordinary item, even though the law had been repealed prior to the disclosure decisions for many firms that had entered into only one such transaction. For the remaining 79 firms, the impact on income had to be rebuilt from the taxes and other income footnotes. Complicating the determination of the impact on net income is the fact that 18 of the 96 firms did not disclose at all the impact of the transactions on deferred taxes. From this information, the concern about disclosure expressed in the FASB Technical Bulletin also appears justified for the selling firms. Although selling firms provided required disclosures of accounting methods dictated by APB 22, disclosures of relationships between tax expense and pretax income required by APB 11 were often incomplete. Most disturbing, however, is the apparent noncompliance with APB 30. As indicated in the Wheeling-Pittsburgh example, the transactions often had a material effect on income. Since the law was repealed, it is hard to understand why no firms chose to report the income as an extraordinary item.

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[19] As mentioned earlier, the new guidelines were not issued until April 13, 1982, long after most of the firms' 1981 annual reports were filed.

Finally, it should be noted that the cash downpayment and related tax impact in the current year was the only dollar figure disclosed by over three-quarters of both groups. Since asset costs, depreciable lives, lease terms, and lease interest rates generally were not disclosed, predicting the impact of these leases on future financial statements is difficult at best.

CONCLUSIONS

The safe harbor leasing provisions lead to large financial transactions between loss firms (seller/lessees) and profitable firms (buyers/lessors) structured as leases to transfer tax benefits and to increase the present values of those benefits to be shared by the parties. For various political reasons, the provision was short-lived. The FASB did not mandate accounting practices regarding these transactions and reporting practice was diverse.

This paper demonstrates the extreme range of income consequences associated with various practices—both those proposed by the FASB in exposure drafts and others. Practice included both very conservative and very liberal consequences with respect to the income reported by particular firms. The study also documents a pattern of apparent noncompliance with GAAP in that disclosures frequently were inadequate to enable statement users to understand the substance of the transactions or to predict future year financial statement consequences.

Since Congress recently passed another substantial revision of income tax laws, The Tax Return Act of 1986, which will dramatically affect the 1987 tax returns for most corporations, the FASB should use the information derived from the experience with safe harbor leasing to address potential issues emanating from the new law. It must weigh the benefits of acting quickly against the costs of guidelines with unnecessary complications. The FASB must also realize that enacting no guidelines most likely will lead to a wide diversity of reporting methods across firms. This is of greatest concern when a law change has a potential for a material impact on income.

APPENDIX A

COMPUTATION OF THE TAX BENEFITS OF THE SAFE HARBOR LEASE BY YEAR OCTOBER EXPOSURE DRAFT

Tables A-1 and A-2 provide an exposition of the allocation of the purchase price under a safe harbor lease between investment tax credits (ITC) and ACRS depreciation deductions following the October exposure draft. First, the net tax deductions (column 2 of Table A-1) are

TABLE A-1
ALLOCATION OF TAX BENEFITS BETWEEN ITC AND DEPRECIATION
(IN MILLIONS)

		Allocation of Tax Deductions		Tax Benefits[3]	
Year (*1*)	*Net Tax Deductions*[1] (2)	*ITC*[2] (3)	*Depreciation* (*4*)	*ITC* (5)	*Depreciation* (*6*)
1981	$15.43	$ 2.20	$13.23	$16.01[4]	$6.09
1982	25.08	3.58	21.50	1.65	9.89
1983	22.63	3.23	19.40	1.49	8.92
1984	21.57	3.08	18.49	1.42	8.51
1985	20.37	2.91	17.46	1.33	8.03
1986	(12.46)		(12.46)		(5.73)
1987	(13.96)		(13.96)		(6.42)
1988	(15.63)		(15.63)		(7.19)
1989	(17.51)		(17.51)		(8.06)
1990	(19.52)		(19.52)		(8.98)
Totals	$26.00	$15.00	$11.00	$21.90	$5.06

[1] Column two of Table 1 – column five of Table 1.
[2] Amount in 1981 = (Amount from column two for 1981 ÷ total in column two for 1981-85) × $15.00.
[3] Columns three and four times 46 percent.
[4] Includes $15.00 tax reduction from investment tax credit.

TABLE A-2
ALLOCATION OF TAX BENEFITS ON ITC BETWEEN COST RECOVERY AND GAIN
(IN MILLIONS)

Year (*1*)	*Cost Allocated to ITC* (2)	*Tax Benefits*[2] (3)	*Reduction of Cost*[3] (*4*)	*Gain Recognized*[4] (5)
1981	$15.00[1]	$16.01	$11.68	$4.33
1982	3.32	1.65	0.69	0.96
1983	2.63	1.49	0.73	0.76
1984	1.90	1.42	0.87	0.55
1985	1.03	1.33	1.03	0.30
Totals		$21.90	$15.00	$6.90

[1] The beginning balance for 1981 of $15 million is the actual tax benefit allocated to ITC in entry one of Table 4. The amount shown for each of the following years is derived by subtracting the amount in column four from the amount in column two.
[2] From column five of Table A-1.
[3] Column three minus column five.
[4] Column two × 28.86 percent, where 28.86 percent is the interest rate that equates the $15 million investment tax credit with the tax benefits allocated to ITC, shown in column three. The percentage is determined using trial and error.

calculated (tax depreciation minus the rental income, column 2 of Table 1 − column 5 of Table 1). The allocation between ITC and depreciation, columns 3 and 4, is made for those years with positive deductions (1981–85). Finally, the tax benefits (columns 5 and 6) are then calculated by multiplying the tax deduction allocations, columns 3 and 4, by the tax rate. For 1981, the ITC tax benefit includes the $15.0 million reduction in taxes payable due to investment tax credit transferred.

The cost allocable to depreciation is recovered through tax benefits allocated to ACRS deductions, column 6. No income or expense is recorded related to depreciation until the entire cost is recovered. During the subsequent period when tax savings exceed initial investment, the right to temporary tax savings will be amortized using a constant interest rate.

Table A-2 shows the allocation of tax benefits on ITC between cost recovery and gain by year. Gain is determined by equating unrecovered cost with yearly tax benefits using a constant interest rate. In this case, gain in year a = unrecovered cost at beginning of year $a \times 28.86$ percent. Cost recovered in year a = cash flow in year a − gain reported in year a.

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EDITORIAL

Education Research Section

The role of the Education Research Section has been unclear since the Executive Committee of the American Accounting Association decided to make *Issues in Accounting Education* a permanent publication. Readers, authors, and reviewers would benefit from clarification of the objectives of the Education Research Section.

This section seeks to promote high quality research effort directed toward solving problems or questions in accounting education. We will emphasize two types of work:

1) original research, based on theory and using appropriate research methods, concerning the effectiveness of alternative
    a) methods of teaching accounting, or
    b) accounting curricula or programs, and
2) tutorials on accounting research that are suitable for use in accounting doctoral research seminars.

Please note the emphasis on accounting. Research that is generic to education and does not address a specific accounting education issue should not be submitted.

We hope to provide worthwhile reading and a valued outlet for accounting education research. We welcome your submissions (please remember the $25 submission fee) and your nominations for the editorial board.

Frank H. Selto, Editor

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EDUCATION RESEARCH

Frank H. Selto, Editor

Evaluation of Teaching Techniques for Introductory Accounting Courses

David R. Vruwink and Janon R. Otto

ABSTRACT: This study tests the effect of homework collection and quizzes on exam scores. Expectancy theory as modified by Porter and Lawler [1968] suggests that performance (a student's exam score) is dependent upon effort, abilities and traits, and role perception (regarding the class). An accounting instructor is able to influence a student's effort through assigning different tasks (teaching techniques) which may include homework collection or quizzes. In this study, a Latin square design allows several teaching techniques to be tested in four accounting classes and controls for possible bias in exam scores resulting from time of class and exam difficulty. Additionally, GPA is used as a covariate. The results indicate that the selected teaching techniques do not significantly affect exam scores.

When accounting instructors are asked why they collect and/or grade homework assignments and give numerous quizzes in their classes, they usually respond that it helps motivate students to study and improves the students' performance on exams. The instructor will most likely respond further with anecdotes of students thanking them because the required homework/quizzes helped them do well in the course.

A majority of students seem to agree with these observations. Farrelly & Hudson [1985] surveyed student preferences regarding teaching techniques in introductory accounting classes. Two of the more popular techniques were giving numerous tests and collecting/grading homework. Students also preferred that a good portion of class time be used in reviewing homework assignments and tests.

Baldwin, Wasson, and Howe [1978] questioned whether collecting and grading homework assignments actually improves student comprehension of accounting concepts and procedures in

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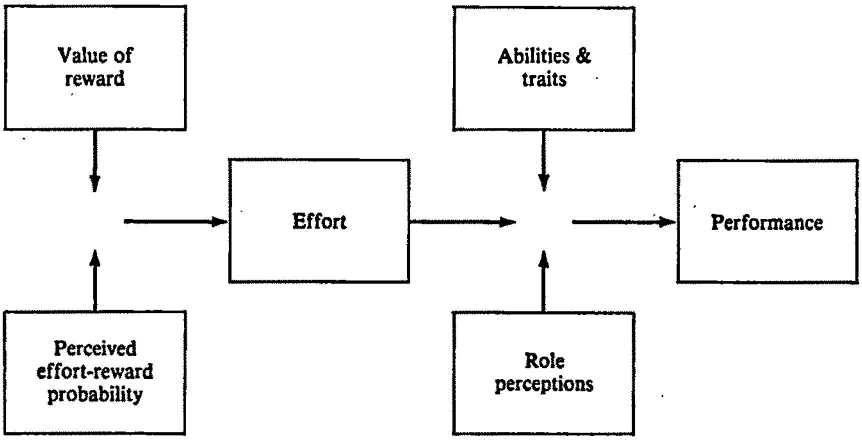
FIGURE 1
A PARTIAL PRESENTATION OF THE PORTER-LAWLER MOTIVATIONAL MODEL



Source: Porter and Lawler [1968, p. 165].

introductory accounting courses. In their study, the exam scores of three classes that had their homework collected and graded were compared with three classes that did not. Mixed results were reported, and the authors suggested that a significant variable such as a student's level of motivation may have been left out of their model.

The purpose of this study is to determine the effect of accounting homework collection and quizzes on exam scores. The exam scores of students who were rewarded for successfully completing homework assignments and quizzes were compared with the exam scores of students who were not. The expected result was improved exam scores for those students who were rewarded for completing the assigned tasks.

THE THEORETICAL MODEL AND HYPOTHESIS

The theoretical model for this study was adapted from Porter and Lawler [1968] and their contribution to the development of expectancy theory.[1] Basically, they state that an individual's job performance is dependent upon (1) the amount of effort expended by an individual, (2) his or her abilities and traits, and (3) role perception regarding his or her work (see Figure 1).

In the classroom, a student's effort is defined as the energy expended to complete the expected or assigned class activities. Two influences on the amount of effort are a student's preference for a potential grade (value of reward) and his or her perception of the probability that an increased amount of effort will lead to the desired grade (perceived effort-reward probability).

An instructor's teaching techniques (assignment and rewarding of different tasks) may influence a student's perceived effort-reward probability and lead to increased effort. For example, a particular teaching technique (random homework collection) could increase the total amount of time that a student spends working on the assigned problems and thinking about the related accounting concepts before an exam. This is likely since a student should see a higher probability of effort being rewarded (through points being given for the completed assignments) than just being told that if he or she completes the daily homework assignments (no reward), exam scores should improve. Thus, by making rewards contingent upon ongoing expenditures of effort throughout the semester, the total amount of effort may be raised.

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[1] See also Strauss & Sayles [1980], Baron [1983], and Luthans [1985] for a further review of expectancy theory.

A student's intelligence and aptitude for course material constitute relevant abilities and traits. These characteristics place an upper limit on the level of performance resulting from applications of effort and are not easily changed over a short period of time. Thus, these traits are considered relatively independent of the influence of the instructor.

The role perception of a student refers to what class activities the student believes he or she should engage in to improve performance in the class. The student may feel that the most effective way to achieve a desired grade is to study only the night before the exam. An instructor may be able to change those beliefs by effectively communicating that completing class assignments and reviewing course material more often should lead to an improved performance on exams.

To summarize, effort, ability, and role perception should explain much of the variation in a student's exam scores. The amount of effort is influenced by a student's value of reward (grade) and perceived effort-reward probability. A student's value of reward and abilities cannot be easily changed by the instructor. An instructor does have influence over a students effort by changing his or her perceived effort-reward probability. The assignment of different tasks may also affect the students' role perceptions.

The hypothesis for this study is that an instructor can improve a student's performance (exam scores) through influencing the student's perceived effort-reward probability. An instructor accomplishes this by assigning tasks (teaching techniques) which are a part of a student's grade and are perceived by the student as a means of improving his or her grade in the class. The student is motivated to increase effort to complete those tasks which should also improve understanding of course material. The expected final result is improved exam scores.

The null hypothesis for this study is:

H_0: Teaching techniques have no significant effect on students' exam scores.

THE STUDY

Two morning classes (7:30 and 8:30) and two afternoon classes (2:30 and 3:30) of managerial accounting were selected for the study, since the classes were taught by the same instructor.[2] Each class met for 50 minutes three times weekly during the semester and received the same daily lecture and homework assignments.

The number of students included in the study from the 7:30, 8:30, 2:30, and 3:30 classes was 36, 58, 41, and 26, respectively. Students who dropped the

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[2] The instructor did miss teaching six of the 45 class days during the semester. However, the same substitute instructor taught all four classes and continued with the experiment. This could have affected the study's results because the main (or substitute) instructor did not teach an equal portion of the experimental cells used in the research design.

TABLE 1
LATIN SQUARE DESIGN

		EXAMS			
		E1 *100 pts.*	*E2* *100 pts.*	*E3* *100 pts.*	*E4* *100 pts.*
CLASS PERIODS	C1 (7:30)	A	B	C	D
	C2 (3:30)	B	C	D	A
	C3 (2:30)	C	D	A	B
	C4 (8:30)	D	A	B	C

TEACHING TECHNIQUES

A: No Quizzes or Homework Collection (0 pts.)
B: Random Homework Collection (24 pts.)
C: Daily Homework Collection (54 pts.)
D: Quizzes (20 pts.)

course or did not take all of the scheduled exams were excluded.

Four exams (each worth 100 points) were administered during the semester. Since classes were both in the morning and in the afternoon, two versions of each exam were prepared. To maintain equal difficulty between the two versions, exam questions and problems focused on the same material, but were worded differently to prevent students in the morning classes from providing answers to students in the afternoon classes.[3]

Four different teaching techniques were tested in the study. The techniques were:

A. No Quizzes or Homework Collection: Students received no incentive to review the material until before the exam. Assigned homework was reviewed in class, but not collected or graded.

B. Random Homework Collection: Homework was collected and graded on a random basis. Each assignment was worth six points and was collected four times during the selected period. Students earned an average of 81.2 percent of the 24 possible points.

C. Daily Homework Collection: Homework was collected and graded for nine designated class periods. Again, each assignment was worth six points. Students earned an average of 94.8 percent of the 54 possible points.

D. Quizzes: Two announced quizzes were given during the selected period. Students earned an average of 66.8 percent of the possible points.

A Latin square design[4] was adopted for the study and is shown in Table 1. An advantage of the Latin square was that it allowed each of the selected teaching techniques to be tested in all four classes. Note that each class received a different teaching technique prior to a scheduled exam and that a particular teaching technique occurs only once for each class period and each exam. This specific Latin square design and the order of teaching techniques for each class were selected on a random basis before the study began.

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[3] The exam scores did not vary significantly between the morning and afternoon classes. The results are shown in a later section of the paper.

[4] See Neter, Wasserman, and Kutner [1985] for a review of Latin square designs.

All students were given a schedule on the first class day explaining in detail the different homework requirements and assigned quizzes that would occur for that particular class during the semester. Students were reminded after each exam that a different teaching technique would be used for the next section of the course.

As shown in Table 1, the four teaching techniques: no homework collection or quizzes (A), random homework collection (B), daily homework collection (C), and quizzes (D), were equal to zero percent, four percent, ten percent, and four percent of a student's total grade, respectively. The unequal weighting was due to the decision not to vary the value of each homework assignment, which minimized the adjustment process for students when changing teaching techniques.

The grading process for homework focused on students completing the assignment while ignoring most errors. This grading procedure and the designation of only six points to each homework assignment were used to encourage students to work the problems themselves instead of searching for the correct answers from other sources.

SELECTION OF RESEARCH DESIGN

A Latin square design was adopted for the study primarily to control for bias resulting from variables which were thought to correlate with the dependent variable but were themselves not of primary concern in the investigation. In this study, there were three such variables: (1) difficulty of exam material, (2) time period of class, and (3) students' different ability levels.[5]

The difficulty of exam material could vary across the four exams given during the semester. For example, students usually have trouble grasping some accounting topics more than others. Also, an instructor would find it almost impossible to construct four exams of the same level of difficulty from different accounting topics.

Since the time of the classes ranged from early morning (7:30) to late afternoon (3:30), student alertness and enthusiasm for reviewing homework assignments and taking exams was expected to vary among the four classes and to have an effect on exam scores. The inclusion of the time period variable in the model also would allow a comparison of class exam scores, which would determine if there was any evidence of communication between classes about exam materials or whether the morning and afternoon versions of each exam were of equal difficulty.

An analysis of covariance (ANACOVA) model with GPA as the concomitant variable was chosen to statistically control the effect of a student's abilities and traits (intelligence, aptitude for course material, etc.) on exam scores. Cumulative GPA prior to the study was selected as a surrogate for a student's ability because it was the only reliable indicator readily available. In addition, Baldwin [1980] found cumulative GPA's

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[5] A fourth variable, the role perception of students, was not included in the model since it is imbedded in the teaching technique variable.

TABLE 2
MEAN EXAM SCORES FOR TEACHING TECHNIQUES

Mean	*Means* Difference Test*	*Motivational Teaching Techniques*
75.72	.29	B: Random Homework Collection
75.08	.55	C: Daily Homework Collection
74.07	.91	D: Quizzes
		Control Treatment
74.23		A: No Quizzes or Homework Collection

* Probability means are not significantly different from Control Treatment.

to be a very good predictor of future test scores. Students who did well on exams in previous classes usually continue to do well in their current classes.

RESULTS

The mean exam scores for the four different teaching techniques appear in Table 2. The highest mean exam scores occurred after homework assignments were collected on a random basis. However, the three motivational teaching techniques varied by less than two percent from the control treatment.

An analysis of covariance was performed with exam score as the dependent variable, cumulative GPA as the covariate, and class period, exam number, and teaching techniques as the independent variables.[6] From Table 3, it can be seen that the *F*-value for the teaching techniques did not meet a reasonable significance level and the null hypothesis could not be rejected. That is, the different teaching techniques had no significant effect on students' exam scores.

The ANACOVA table also shows that the mean exam scores for the two morning classes were not significantly different from the mean exam scores of the afternoon classes when the exam scores were adjusted for the GPA of each student.[7] This suggests that either the two versions of each exam were of equal difficulty and that there was no feedback of exam material between the morning and afternoon classes or that the later exam was harder but this effect was cancelled by feedback.

The *F*-value of the other blocking variable (exam number) was significant and indicates that the difficulty of the four exams did vary widely during the semester as different accounting topics were covered. Thus, using the different exams as a blocking variable reduced the experimental error in the study.

CONCLUSION

The results of this study were unable to provide evidence that collecting/grad-

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[6] Tukey's test for additivity was conducted to determine if any interaction effects existed among the blocking variables and treatments (teaching techniques). At a five percent significance level, the Tukey test results ($F = .392$) allowed a conclusion that the effects of the blocking variables and treatments are additive.

[7] In a second analysis, the class period variable was broken into four categories (7:30, 8:30, 2:30, 3:30 classes) instead of two (AM/PM classes). The results were similar.

TABLE 3

ANACOVA RESULTS FOR TEACHING TECHNIQUES, CLASS PERIODS, EXAMS, AND GPA

Source of Variation	*Sum of Squares*	*d.f.*	*Mean Squares*	*F*
Teaching Techniques	273.62	3	91.20	.60
Class Periods (AM/PM)	170.97	1	170.97	1.12
Exams	10,139.12	3	3,379.70	22.22*
GPA (covariate)	32,920.86	1	32,920.86	216.48*
Error	96,565.74	635	152.07	
Total	140,070.31	643		

* $p < .01$

ing accounting homework assignments and giving quizzes have an effect on students' exam scores. While students may perceive a benefit from homework and quizzes and expect introductory accounting courses to utilize them, their exam performance did not significantly improve in this study when they were rewarded for successfully completing those tasks.

A limitation of the study was that the time period of each treatment was only one-fourth of the semester. If the time period of each treatment had been lengthened, students would have had more time to adjust to the different teaching techniques and the results may have been different.

A second limitation was that the reward associated with each individual teaching technique may have been too small to motivate students to increase their effort to thoroughly understand and complete the assigned tasks. Also, an unequal weighting (number of points) of the motivational teaching techniques could have confounded the study's results. The effort applied to exams may have varied due to the different number of points rather than the change in teaching techniques.

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BOOK REVIEWS

Richard P. Brief, Editor

Editor's Note: Books for review should be sent to Professor Richard P. Brief, 520 Tisch Hall, College of Business and Public Administration, New York University, New York, NY 10003.

JERRY L. ARNOLD and WILLIAM W. HOLDER, *Impact of Statement 52 on Decisions, Financial Reports and Attitudes* (Morristown, NJ: Financial Executives Research Foundation, 1986, pp. viii, 156, $12.00 paper).

This research report is based on the 1983 annual reports of 172 of the Fortune 500 Industrials, interviews with financial executives from 22 companies and 29 financial analysts. The primary objective is to evaluate the impact of SFAS No. 52 on financial statements, their preparers, and financial analysts.

The first phase studied the impact of SFAS No. 52 on key statement elements, financial ratios, and other relationships. Data also were collected on the foreign operations and export sales disclosures of SFAS No. 14, "Financial Reporting for Segments of an Enterprise." The importance of the relationship between the extent of foreign operations and the impact of SFAS No. 52 is underscored by the preparers and financial analysts interviewed. However, it is not analyzed.

The results of this phase provide some useful insights into the effect of SFAS No. 52. Specifically, the relevance of the translation effect in the evaluation of multinational corporations is highlighted. The income effect also is substantial. However, the income effect can be a combination of transaction gains and losses and the effects of translating the financial statements of foreign affiliates using the U.S. dollar as their functional currency. These components lead to different inferences for current and future cash flows but they are not reported separately, a shortcoming of SFAS No. 52 that should have been discussed.

The examples of various disclosures and excerpts from the Management Discussion and Analysis section of the annual reports also are illuminating. However, there are some *caveats.* The tenor of the evaluation is essentially descriptive rather than analytical and this may be due to the use of a single year's data. The researchers note that the study was conducted during a period of a very strong dollar and recommend a replication when the dollar is weak. Thus, the underlying economic conditions reduce the generalizability of the conclusions. Another significant problem is the lack of data and analysis of the standard's impact on the Statement of Changes in Financial Position. (Some examples do show the effect of exchange rate changes on Working Capital.) Given the importance attached to the Statement of Changes in Financial Position, this omission is an important one.

The second phase of the study reports the results of in-depth interviews with executives of 18 companies using the local currency and four that used the U.S. dollar as the functional currency. The interviews suggest an overwhelmingly favorable response to the standard for two reasons. First, it removes much of the volatility in reporting earnings and second, it reduces the need for hedging accounting exposure. The top management of one company expressed "considerable disinterest in the subject" after the adoption of this standard. This is unfortunate given the significance of investment in foreign operations.

The study provides useful documentation of foreign currency management and hedging practices. In particular, the emphasis on centralized hedging is an interesting finding. Also, some executives expressed concern about the arbitrary nature of guidelines for highly inflationary economies and it may be useful to study further cases where managements opt for the local currency and then find that they have to recognize the impairment of assets in a later period.

Accounting implementation issues are discussed next. This section identifies problems encountered by preparers in applying the standard to the Statement of Changes in Financial Position. The responses suggest the key criterion used to select functional currency is the currency in which operating cash flows are realized. Revisions of the original functional currency decisions were rare. However, this conclusion could change in the future. One of the most useful findings is that "management did not fully comprehend the role of currency fluctuations on cost of sales and SFAS No. 52 helped demonstrate this." Thus, the use of the functional currency, the current rate, and the reporting requirements appear to have increased understanding of the relevance of reporting translation effects, and this is an important result of the standard setting process.

The final section of the study probed the perspectives, beliefs, and attitudes of 29 financial analysts including accounting experts, industry experts, and general analysts. Most analysts emphasized the need to predict future earnings and cash flows. They also felt that to understand the investment (net asset) strategy of reporting companies, disclosures should facilitate the disaggregation of currency variation effects and basic operating results of foreign operations. The analysts pointed out that current disclosure requirements are inadequate. Suggestions by the accounting experts (among the analysts) for improved financial disclosures to allow such analyses were useful. However, the final conclusion of this study was more disturbing (p. 128): "Analysts . . . would like more complex information, . . . yet, they do not fully understand what they are currently receiving." Arnold and Holder go on to question the effectiveness of analysts in contributing to efficient capital markets. The apparent lack of awareness and understanding of the standard's requirement by many analysts represents a serious problem.

This research report is a useful study of the impact of Statement No. 52 on companies, preparers, and analysts. However, it does not evaluate SFAS No. 52 relative to the previous standard and the use of a single year of data did not allow an empirical analysis of the economic effect of the new standard. Also, given the importance of cash flows, the absence of an analysis of fund statement reporting and disclosure is unfortunate.

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W. T. BAXTER, *Inflation Accounting* (Oxford, England: Philip Allan Publishers Limited, 1984, pp. viii, 296, $21.00 paper, $42.00 cloth).

This book updates the author's *Accounting Values and Inflation*, which was published in 1975, and includes an analysis of inflation accounting pronouncements issued in Great Britain and the U.S.A.

Professor Baxter provides a solid conceptual foundation at the beginning of the book and deals first with such topics as general versus specific price changes, the use of indexes, and concepts of wealth and income. He then compares alternative approaches to inflation accounting using detailed numerical examples. There is also a careful analysis of measurement issues. One of the key discussions is whether economic or physical growth should be considered in income determination, and Baxter concludes that by themselves neither general index restatement nor specific price reevaluation is a satisfactory solution. He argues that the "constant purchasing power" approach gives a more logical measure of income than "current cost accounting" and provides a better assessment of the economic loss associated with holding monetary assets during a period of inflation. He also suggests that current cost accounting provides a better measure of an asset's value and is necessary for calculating a real holding gain (loss) on nonmonetary assets. Therefore, a hybrid method that includes aspects of both approaches is proposed.

Baxter is convinced that some form of inflation accounting is necessary and that a partial cure is better than none. He admits that the outlook for reform is very uncertain (which is somewhat prophetic considering the FASB's recent decision that inflation disclosures should be encouraged but not required).

The publisher suggests that this book is designed to introduce students to the techniques and theories of inflation accounting. While I have a great deal of respect for Professor Baxter's book, I doubt that it would be a good choice for a required reading list. He takes an axiomatic approach to his work, much in the tradition of Chambers or Edwards and Bell. As a result, the growing body of empirical research on inflation accounting is not discussed. Further, in building the case for inflation adjustments, Baxter mentions a variety of economic errors that may be caused by the failure to adjust historical accounts for inflation. But there are many who will not be persuaded by arguments for inflation accounting if they rest on an assumption of functional fixation.

In the brief discussion of the arguments against inflation accounting, Baxter does not consider the reasons why most analysts and managers fail to see any relevance in the disclosure of inflation-adjusted data. It is at this point that the need to discuss empirical evidence becomes most evident. The book would be much stronger if an attempt had been made to reconcile the arguments for inflation accounting with the growing body of literature which suggests that inflation-adjusted data are not used.

My criticism of Baxter's book arises in large part because I think it needs a more balanced discussion of the empirical research on inflation accounting. However, I do think the book provides many new and useful insights as well as some excellent examples that can be used effectively in the teaching of inflation accounting.

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PAUL BRIGGS, Editorial Coordinator, *The Growth of Arthur Andersen & Co. 1928–1973. An Oral History by Leonard Spacek* (Chicago: Arthur Andersen & Co., 1985, pp. v, 348 paper).

Editor's Note: Copies of the book are available on a loan basis from: Firm Secretary, Arthur Andersen & Co., 69 West Washington Street, Chicago, IL 60602, or Professor Bala V. Balachandran, Accounting and Information Systems Department, J. L. Kellogg Graduate School of Management, Northwestern University, Leverone Hall, Evanston, IL 60201. Copies of the set of nine videotapes also are available on a loan from Northwestern University at the above address.

This volume represents a pioneering effort in oral accounting history to document the role of one of the principal figures in the development of the American CPA profession and his relation to others in his firm and the community. Overall the work is well prepared, carefully typescripted, and free of error. It is informally printed and bound, but is well supported with an alphabetical index at the rear of the volume. While some episodes are repeated during each of the four oral "taping" sessions which provide the basis for the manuscript, such distractions are minor. The value of this work lies in its candor and originality. One gets the clear impression that many of these episodes have never been made public before—there is a special "now it can be told" quality which does not digress unduly into sessions of politely overdone homage.

The work promises candid treatment of several matters including Mr. Andersen's personality, the difficulties in arranging for the continuation of the firm upon Andersen's death, and the fervor that Spacek had for "developing a large firm" and ensuring that service to the client and the worldwide concept of "one firm" were paramount in the thinking of partners.

The reader is provided with Spacek's views about his disagreements with the American Institute of CPAs which stemmed from a controversy over a series of speeches given during the 1950s. The climax was the famous "Milwaukee speech" in which he noted that the only reason for misleading financial statements is the failure or the unwillingness of the public accounting profession to reconcile accounting principles with its professional responsibility. AICPA leaders were appalled. Membership indignation greeted the speech. A special committee was formed to consider the allegations Spacek had made. Finally the matter was brought to AICPA Council for action. In Spacek's words: "Three hundred Council members voting on me as to whether I stay in the profession or not . . . The vote to oust me didn't succeed . . . They wouldn't go along with this kind of a vote . . ." (p. 243).

An appreciation for Spacek's dedication to the concept of an Accounting Court and the Fairness Principle can be gained from considering his views of the alternatives available at the time, and his personal interest in the process by which the courts decided difficult issues. Importantly, as well, several of the assumptions about the polite nature of retaining clients during the pre-advertising days are unmasked.

There is humor (p. 221) when Mr. Spacek resolves the issue of wearing "colored shirts." Interesting insights also are provided in the discussion of education development (p. 133), technical issues (p. 244), as in the case of goodwill, and (p. 230) the investment credit episode. Recollections about early attempts to employ computers to assist in property record systems and accounting applications also lend perspective to the role that accountants played in such developments.

For those who enjoy biography and institutional history and a work which reads rapidly, this is an important addition to the literature describing the development of the American accounting profession. The reader does get the impression, however, that there is more to some of the episodes than can be told, even at this time. And certain episodes, for instance, Spacek's relationship with Paul Grady, are not discussed in the depth that one might wish. Perhaps a supplemental volume will be considered.

This oral history provides us with an opportunity to increase our understanding about the thinking of the "maverick" and the leader who was and is Leonard Spacek. It also serves to establish the significance of Mr. Spacek's contributions and to validate the oral history as a method for documenting the views of contemporary leaders.

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CARL T. DEVINE, *Essays in Accounting Theory,* Studies in Accounting Research #22 (Sarasota, FL: American Accounting Association, 1985; Volume I: pp. vii, 165; Volume II: pp. v, 151; Volume III: pp. viii, 135; Volume IV: pp. viii, 184; Volume V: pp. viii, 213; each volume $8.00 paper—members, $12.00 paper—nonmembers; set $50.00 cloth—members, $80.00 cloth—nonmembers).

Professor Devine's essays fall into three broad topical areas, appropriate perhaps for three doctoral seminars: (1) theory construction and verification, (2) behavioral considerations, and (3) income theory and current reporting issues. In the reviews below, the volume and essay number of particularly relevant essays are shown in parentheses.

Theory Construction and Verification

Devine's approach to the development of accounting theory may be summarized as follows (I-1):

1. The value systems of individuals are diverse (V-1, V-5). However, the behavior of individuals can be observed to ascertain socially desirable, or consensus, patterns of behavior (I-6). Inferences can then be made about the ends or objectives toward which efforts of goal-seeking individuals are directed.
2. A model for measuring the results of actual behavior must be developed (deduced) from the ends identified above. This model must be capable of tracking (measuring) the progress of individuals toward the desirable ends. The role of accounting theory is to provide an explanatory link between the measurement model and the ends or objectives (I-10, III-1, IV-5).

The paramount role of objectives in a means-end framework is a common thread throughout Devine's essays. Identifying these objectives and constantly monitoring the behavior of individuals for changes in these objectives is a central task of accountants. The design of measurement models, and development of related theory underlying the models, requires that the accountant be intimately knowledgeable of users' ends or objectives. Thus, accounting takes on a heavily behavioral tone, both in inferring ends and in measuring actual performance. Devine does not rule out the important role played by model builders and deductive structures. Their role, however, is one of organizing a series of propositions for assessment at the empirical level.

Devine's expository style is to position his suggested approach to theory development between extremes along a continuum. For example, his approach (operationalism) relies on the empiricism of the pragmatists but sees the value of structural models demanded by the positivists. He sees the value of global solutions offered by systems builders but recognizes that capturing diverse behavior patterns in a total system framework is an unattainable ideal. He likes the incorporation of cost-benefit tradeoffs and probability theory in information economic models but worries that the resulting optimization models cannot adequately capture the behaviorally-oriented objectives of human endeavor.

The readers of the theory-oriented essays will find themselves stretched into some fascinating directions that tie accounting issues to related issues in other disciplines. The task of developing measurement rules in accounting is viewed within the larger surrogate/principal relationship underlying measurement theory (I-10). The quest for evidence to support the development of accounting theory is discussed in light of the gathering of evidential support in the legal profession (I-11, 12). Several essays explore different approaches to developing theory (I-1, III-5, V-4, 5) and philosophical aspects of the scientific method (II-13, 14).

Devine does not leave the reader at an abstract philosophical level but continually relates issues in theory development to the current accounting literature. Difficulties encountered in the areas of event recognition and changing prices are related to the lack of a clearly articulated set of users' objectives (I-2). Efforts to develop comprehensive treatises on accounting theory (Chambers, Moonitz and Sprouse, Littleton) are posited to fall short because of inattention to users' objectives or too little emphasis on testable models (III-2, 4).

Devine's essays were written over a period of many decades. Other than minor editing, Devine did not revise earlier essays as his thinking crystallized. Rather, he added new essays in later volumes. This is evident in essays in the last volume on topics such as the impact of individual value systems on perceptions of experience (V-1), the contrast between positivism and pragmatism (V-4), and the development of ethical standards in light of diverse value systems (V-5). By reading the essays sequentially, the reader gets a unique glimpse at the evolution of thinking of one of the profession's most respected scholars. Through Devine's reviews and comments, the reader also gets an opportunity to revisit most of the other major efforts at theory development of the last three decades. One difficulty with this chronological organization of essays, though, is that the reader must exert considerable effort to piece together the critical threads of Devine's thinking across the five volumes.

Given the wide array of research techniques and the volume of analytical and empirical research to which doctoral students must currently be exposed, there is likely to be an understandable tendency to exclude mind-broadening philosophical readings that appear to have little immediate applicability to one's next research study. If this is the case, students (scholars) miss an opportunity to explore current accounting issues at a broader, interdisciplinary level, perhaps setting the stage for following a similarly narrow viewpoint throughout their professional careers.

Behavioral Considerations

Devine was one of the first accounting theorists to emphasize the behavioral foundations of accounting. Consider the following statement, which not only makes the behavioral point but also provides a concise summary of his view of the role of accounting in society.

> Accountants are concerned with individuals striving for objectives. Accountants attempt to furnish an information-control system that helps these individuals attain their goals. In the process accountants identify events that promise to be pertinent to future decisions and actions; they select aspects of these events that promise to be useful, and they construct conventions for measuring and reporting relevant aspects of the selected events. In short, accounting is part of behavioral science (I-Foreword).

These essays examine a variety of behavioral concepts including theories from psychology (I-5, IV-9), sociology (I-6, IV-11, V-2), and organization theory (IV-8, V-2). The preceding references are intended only as examples since behavioral concepts are discussed throughout the five volumes. The author's approach is to search for plausible linkages with accounting and raise questions rather than to attempt the resolution of particular accounting issues.

Devine's behavioral criteria for an accounting system appear to be:

1. User-focused: Accounting should serve the needs and objectives of legitimate users. "The task is one of identifying and ordering users, inferring needs, weighing relative importance, and predicting consequences" (V-p. 20).
2. Culturally and situationally oriented: This criterion suggests that it will not be possible to develop a global set of accounting principles.
3. Pragmatic: Accountants need not support everything they do with a theoretical model. The primary test should be: Will the information assist users in making decisions about the future? "Inasmuch as choices must be made and normative guidelines set forth, accountants must do what is generally impossible and get on with their professional work" (V-p. 83).

Devine questions whether existing accounting systems meet the above criteria. For example, he suggests that accountants may be ". . . prime examples of organizational bureaucrats. . . ." They follow the organization rules and ordinarily make little inquiry ". . . about the rationality or effectiveness of the rules themselves" (IV-p. 172). Accountants have an obligation to ask if the internal rules are consistent with organizational goals and with society's needs and demands (IV-p. 152).

Individuals, and in particular doctoral students, interested in obtaining an increased understanding of the relationships between the behavioral sciences and accounting will find these essays thoughtful and challenging. (Moreover, there are virtually unlimited ideas for researchable issues.) A good place to begin might be essay I-5. The following sentences from that essay may be nearly as true today as when they were written 25 years ago.

> Accounting is the leading form of the communication-and-control language of business, and it would seem to follow that accountants should be at home among the concepts of psychology, sociology, and the behavioral sciences in general. The truth is that accountants have almost no such knowledge, have developed little rapport with these related fields, and have made some fantastically naive behavioral assumptions (along with some reasonably astute ones).

Devine's essays are an outstanding contribution to accounting literature. More specifically, his exploration of behavioral issues is superb and should be required reading for anyone contemplating research in "behavioral accounting."

Income Theory and Current Reporting Issues

In developing his essays on income theory and current reporting issues, Devine is guided by his dictum that the "whole function of accounting is related to decision making" (IV-4). He is careful, however, to keep his options open as to the identity of the decision maker so that his general means-ends chain approach is used to explain a wide variety of accounting phenomena. For example, Devine develops theories at different points where the decision maker is management (II-2), the auditor (III-6), investors (II-3, IV-2), and the entity itself (II-1, V-8).

Further, he addresses a bewildering array of abstract subjects including the entity, continuity, organizational slack, smoothing, managerial intent, discounting, holding gains, goodwill, interim reporting, and prediction. In addition, he develops means of evaluating alternative theories about full vs. absorption costing, LIFO-FIFO, fixed vs. variable costs, short-run/long-run tradeoffs, accrual vs. cash flow, earnings and realization, cost vs. value, and GPL-current cost. In all of these discussions, Devine maintains an internal consistency in thought that is admirable. He also brings a consistent, broadly-based integrative scholarship that makes these essays must reading for any student of accounting, whether 20 or 60 years old. It matters little that most of his references are 20, 30, or 50 years old. To a generation that considers "classical" to be anything older than 1966, and an accounting journal not worth keeping if it is older than ten years, these carefully developed arguments must be real eyeopeners.

Devine's concern with internal management (his little-known *Cost Accounting* published in 1950 was decades ahead of its time) is evident throughout. Thus, not only is there concern with decision making, but also concern with how the data prepared to facilitate decision making are conditioned (tainted?) by managerial intent, managerial objectives, managerial measurement, and managerial control. But the analysis does not stop with these; it is merely the prelude for discussing the final (external) reports and the implications thereof.

For example, in the full cost/absorption cost discussions (II-6, 11, 12; III-9 and IV-1) he brings to bear the notions that fixed costs are surrogates (under certain conditions) for opportunity costs, and through the monitoring of individual products these costs can contribute to product-mix problems. As such, the plant manager, in charging for fixed costs, not only signals that these are not free goods, but also signals (implicitly) that the product manager must include these costs in internal pricing, and if the manager is not able to absorb them, the accounting immediately signals an investigation of the product or its manager. Furthermore, when extended to external reporting, direct costing would indicate no fixed costs in the decision, and thus no opportunity cost surrogate for capacity, which may lead to dysfunctional decisions. Devine thus ties together managerial intent, managerial decisions, internal and external pricing, control (through fixed overhead to measure idleness or undercapacity), and external decision making (III-9), which in turn is calling attention to possibly sick products or areas. In effect, he demonstrates his point that control is meaningful only in the context of predicting the consequences of manipulating variables.

Devine, as do most academics, also spends considerable effort on the historical cost/current cost problem. He is far from simplistic, however, and offers one of the few integrated discussions. He is not satisfied simply to make assertions about the superiority of current costs, but extends the discussion to questions of resource allocation, short-run decisions about stewardship, and income surrogates. In brief, he looks to the explanatory power of any accounting measurement. A shortcoming: Devine rails against accountants' blindness in refusing to adopt inflation accounting, but nonetheless offers no behavioral explanation of why managements and accountants have steadfastly refused to adopt inflation accounting in any meaningful way—i.e., why inflation accounting has not met the test of the market.

It is impossible to give more than a flavor of this series of essays. Truly, here the model is the whole five volumes. The reader must read the essays. In concluding, this reviewer leaves you with another Devine imperative:

> I, along with many other present-day academic accountants, am growing concerned over what appears to be a new parochialism in accounting research, i.e., a tendency to restrict research to the narrow confines of quantitative methods . . . there remains a vague uneasiness that the profession is limiting its horizons instead of broadening them . . . the profession must not be permitted to define itself into a wasteland of repetitive calculations and vacuous assertions. (Foreword to Volume V)

Devine, in these essays, has struck a powerful argument against this trend.

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Editor's Note: Hector R. Anton wrote the section, "Income Theory and Current Reporting Issues"; Edwin H. Caplan wrote the section, "Behavioral Considerations"; and Clyde P. Stickney wrote the section, "Theory Construction and Verification." This review was commissioned by the former book review editor, Harvey S. Hendrickson.

CHRIS ROBINSON and LEN FERTUCK, *Materiality: An Empirical Study of Actual Auditor Decisions* (Vancouver, B.C.: The Canadian Certified General Accountants' Research Foundation, 1985, pp. ix, 61, Can. $11.50 paper).

This monograph is the twelfth in a series published by the Canadian Certified General Accountants' Research Foundation. After reviewing the authoritative literature and prior empirical work on materiality, the authors report the results of their rather unique investigation of 455 errors upon which a decision to correct or waive correction had been made in actual audits of 61 companies, conducted by 15 partners of three accounting firms.

To estimate a percent of net income threshold that discriminated between material and immaterial errors, the authors used logistic regression. The estimate was 11 percent. This threshold correctly classified 90 percent of the 358 errors that affected income. This performance is rather lackluster in light of the fact that the sample was comprised of 87 percent immaterial items. That is to say, a naive model which classified all observations as immaterial would have classified with 87 percent accuracy.

The authors expanded the logistic regression to include several additional variables including whether the client opposed correction, the client debt/asset ratio, and whether the magnitude of the error was objectively determined or only estimated. The expanded model correctly classified 92 percent of the errors, a modest improvement over its univariate counterpart. Both models had difficulty in explaining why seemingly small errors had been corrected.

Of course, multiple errors for the same company may be individually immaterial but material in the aggregate. Accordingly, the authors examined the 14 audits in which more than one error affecting income had been detected. In two of these audits, the cumulative income effect of immaterial errors exceeded the cumulative income effect of material errors. And in two of the others, the cumulative income effect of material errors was small. The authors interpret this result as neither contradicting nor supporting the proposition that materiality decisions are based on the cumulative effects of errors.

In many contexts, use of real data represents a significant improvement over the use of hypothetical data. However, use of real data may contaminate inferences about actual materiality thresholds. As an example, consider the following hypothetical situation in which the actual materiality threshold is ten percent. Assume that revenue is correctly stated at $100.00, and that expenses consist of four items, audit of which resulted in the following:

Item	*Recorded balance*	*Audited balance*	*Error*
1	$ 7.00	$ 9.20	$2.20
2	35.00	35.00	—0—
3	29.00	31.00	2.00
4	8.00	10.20	2.20
	$79.00	$85.40	

The recorded net income is $100.00-$79.00 =$21.00, and the ten percent threshold would result in only the errors in items 1 and 4 being corrected (they exceed $2.10). Accordingly, the audited net income would be $100.00-$83.40

=\$16.60. The two errors that were corrected are each 13 percent of audited net income. The one immaterial error is 12 percent of audited net income. It thus *appears* that the materiality threshold is between 12 and 13 percent, when it is actually ten percent. Robinson and Fertuck do not specify whether they used recorded or audited net income as the denominator in their materiality calculations. If they used the audited value reported in the financial statements, then their results may be biased as in the above example. Moreover, bias may have resulted from the fact that use of a materiality threshold in audit sampling discriminates against smaller items becoming available for study.

Materiality is an extremely difficult phenomenon to study. Despite the above problems, it is my belief that the research was well performed and that this study constitutes an important contribution to the literature.

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DAVID SOLOMONS, *Making Accounting Policy* (New York: Oxford University Press, 1986, pp. ix, 261, \$17.95).

This book is the third in The Wharton Executive Library series. The series attempts, through short readable works by authoritative authors, to close the gap between the time useful academic research is first published in scholarly journals and the time it eventually comes to the attention of practicing managers in nontechnical journals. Solomons meets this objective.

The subtitle, "The Quest For Credibility in Financial Reporting," accurately describes the thrust. The story is presented primarily through a very fair description and evaluation of the FASB's efforts to improve the quality of financial reporting and, thereby, its credibility. Intertwined throughout the discussion are the author's arguments for his already well documented preference for a measurement system based on current costs. These views, which Solomons acknowledges are not widely shared, are presented as recommendations to those responsible for setting the direction of future accounting decisions.

The book is designed to appeal to several different classes of readers; accordingly, some readers might not be interested in all parts of the book. Executives and young academics trying to comprehend the FASB's current decisions and its decision-making processes will find Chapter 2's discussion of the FASB's antecedents very helpful. Businessmen and practicing accountants will find Chapters 4 and 5, which discuss the objectives of financial reporting and the quality of accounting information, particularly useful guides for the exercise of responsible judgment in dealing with financial reporting issues. The author suggests that the primary quality to be sought is the usefulness for decision-making purposes of the accounting information that is being communicated. Chapter 10 covers the relevance of the efficient market hypothesis and related empirical research to standard setting. Those interested in accounting theory will find provocative the conclusion that empirical research can only make a limited contribution to the standard setter.

The recommendations for moving toward more credible accounting standards deserve the attention of those concerned with this issue. Solomons concludes by observing that our traditional accounting methods are deficient and that these deficiencies give rise to conflicts between competing economic interests. These conflicts, he believes, could be avoided if theoretical foundations of accounting were more soundly based. However, this is not enough. Before accounting standards can achieve their purpose, they must also be accepted by the financial community.

These conclusions strike a responsible and pragmatic balance between the views of those who advocate deriving accounting standards from theoretical, conceptual models and those who support the notion that accounting standards ought to evolve out of business practice. In the opinion of this reviewer, Solomons' support and articulation of this balanced approach to the setting of accounting standards is the real contribution of this excellent book.

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DAVID WAINMAN, *Currency Fluctuation: Accounting and Taxation Implications*, Second Edition (Cambridge and Dover, NH: Woodhead-Faulkner Ltd., 1984, pp. vi, 202, £17.50, \$29.00).

In this era of fluctuating exchange rates and with the continual development of currency management techniques and accounting practices, a need exists for state-of-the-art contributions to the literature of currency accounting. These may be research monographs, "best practice" textbooks, normative analyses, or reference works. This book belongs essentially in the last category, but with an analytical intent. Prompted by the closer alignment of United Kingdom, United States, Canadian, and Australian currency accounting standards in 1983 and an important UK tax case in 1984, Wainman seeks to update "thinking accountants and commercial men" (p. 14) on the currency accounting and taxation debates. Following his view that development of currency accounting is an evolutionary process, Wainman briefly traces the history of previous standards and tax cases; concentrates on describing, demonstrating, analysing, and evaluating contemporary practice; and hints at ways forward.

The approach adopted by Wainman, a tax partner in Ernst and Whinney's London office, is *technical.* The exposition, development, and denouement are each grounded in recent accounting standards and tax cases. The author declares that "accountancy is learnt only with a pencil in hand" (p. 21) and accordingly his recognition and discussion of issues tend to be within a bookkeeping framework. Accounting problems, methods, and solutions often are handled through numeric examples, generally in accounts format, while the sequencing of issues tends to relate to his core reference points, namely SSAP 20 (closely related to SFAS 52) and the tax case *Pattison* (*HM Inspector of Taxes*) v *Marine Midland Bank Ltd.*

The advantages of this approach are that the contemporary context is in the forefront, problems and methods are made concrete rather than abstract, and the complexity and variety of real-world currency accounting and tax matters are made evident. The disadvantages are that the key theoretical issues or principal practical problems do not stand out and "theory" can become a rationalisation of recent accounting standards and case law. Furthermore, user needs in currency accounting are largely ignored and neither by design nor execution can such an approach recognise the total set of accountancy and measurement problems that fluctuating currencies bring.

This book also is very British. The standards of other countries are not examined and this means that SSAP 20's central concepts of net investment and the cover method are examined and appraised in depth. The chapter on exchange control, despite the author's contrary claim, may not be instructive for other regimes or relevant to any future reinstatement of controls in the UK. The two chapters on taxation are based on English case law, which Wainman admits is limited to date.

The significance he attaches to the Marine Midland case is that the House of Lords, especially Lord Templeman, distinguished very clearly between exchange gains and losses due to conversion and those due to translation. Indeed the ruling was that the translation differences in an apparently complex wholesale bank operation were not taxable. (It is interesting to note that leading lawyers confronted with the intricacies of foreign exchange risk seem able to comprehend the different exposures that arise more readily than do many accountants or executives.) The author then relates this taxation verdict to his discussion of the net investment concept in accounting and he suggests that the steps required in developing currency accounting and taxation still are evolutionary and hinge on closer definition of net investment situations.

The value of the book probably lies in its reference qualities. The business or audit accountant will find many of his detailed currency accounting problems discussed and often will find enlightenment. The tax accountant likewise might access the book for clues on how to disentangle a tax case "with profit." For those influencing and setting accounting standards, the book does remind us both just how complex is currency accounting and that the detail may be as important as the concepts.

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NEW BOOKS: AN ANNOTATED LISTING

Editor's Note: As a general policy, books received but not reviewed in this or future issues will be annotated. There will be some exceptions.

HERMAN W. BEVIS, *Corporate Financial Reporting in a Competitive Economy,* Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1965] 1986, pp. ix, 212, $35.00).

Originally published for the program for Studies of the Modern Corporation of Columbia University Graduate School of Business in 1965. Nine chapters address the forces and needs underlying corporate financial reporting, how corporate financial reporting responds to those forces and needs, and the people responsible for financial reports. At the time of original publication, Herman Bevis was Senior Partner of Price Waterhouse & Co. and a member of the Accounting Principles Board of the AICPA.

CHARLES P. BONINI, ROBERT K. JAEDICKE, and HARVEY M. WAGNER, Editors, *Management Controls: New Directions in Basic Research,* Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1963] 1986, pp. xviii, 341, $55.00).

Papers presented at the Seminar on Basic Research in Management Control, sponsored by the Graduate School of Business, Stanford University, in 1963. Includes 16 formal papers and related discussions by leading scholars then engaged in basic research having a direct bearing on management control. General topics include the relationships between management control and economic theory, simulation, the budgetary process and behavioral science and, from a broader perspective, control in organizations and society. At the time of original publication, Charles Bonini and Robert Jaedicke were Associate Professors and Harvey Wagner was Professor at Stanford University.

RICHARD P. BRIEF, Editor, *Corporate Financial Reporting and Analysis in the Early 1900s,* Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., 1986, pp. 234, $24.00).

Anthology contains a reprint of 1902 recommendation for corporate financial reporting by Thomas W. Phillips, a member of the U.S. Industrial Commission; four annual reports: United States Steel, 1902; International Harvester, 1909; American Telephone & Telegraph, 1910; and Westinghouse Electric & Manufacturing Co., 1911; and several papers analyzing the financial statements of selected companies that were originally published in the *Journal of Accountancy* from 1906-1909. The editor is Professor of Business Statistics and Accounting at New York University.

RICHARD P. BRIEF, Editor, *Estimating the Economic Rate of Return from Accounting Data,* Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., 1986, pp. 201, $22.00).

Reprints ten articles and six notes and comments addressing the problem of using accounting data to estimate the economic rate of return. Seven of these papers were published in British journals and the rest appeared in U.S. publications. All papers were written over the last 20 years. The editor is Professor of Business Statistics and Accounting at New York University.

PHILIP BROWN, Editor, *1986 Directory of Accounting Academics–Australia and New Zealand* (Nedlands, Western Australia: The University of Western Australia, 1986, pp. 163).

Sixth edition of the Directory of Australasian academics. Includes areas of teaching responsibilities, academic and professional qualifications, and prior academic and management positions of 821 staff members in accounting and allied fields from 54 universities and colleges of advanced education in Australia and New Zealand. Two separate lists group information alphabetically by institution, including address, and by academics' last names. The editor is at the Department of Accounting and Finance, The University of Western Australia, Nedlands, Western Australia 6009.

JOHN L. CAREY and WILLIAM O. DOHERTY, Editors, *Ethical Standards of the Accounting Profession*, Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1966] 1986, pp. x, 330, $55.00).

Reprint of the 1966 revision of Carey's *Professional Ethics of Certified Public Accountants*, first published in 1956. Book emphasizes general ethical principles as guides to practitioners in determining the proper course to follow in specific circumstances. The volume addresses the issues of independence, rules on advertising, solicitation and fee-sharing, opinions on financial statements, tax practice, and management services, including the impact on accounting ethics of the computer revolution.

Computer Control Guidelines, Second Edition (Toronto: The Canadian Institute of Chartered Accountants, 1986, pp. 197, Can. $32.50 paper).

Purpose is to provide guidance on computer control objectives and control standards for information systems. Classifies individual control techniques according to their contribution to these standards. Contains a glossary of basic terms. An earlier edition was published in 1970. The contributors are members of a study group of The Canadian Institute of Chartered Accountants.

SANTIAGO N. ESTRADA, *La Amortizacion de los Activos Fijos en la Teoria Contable* (Mendoza, Argentina: Inca Editorial, 1985, pp. 130).

Doctoral thesis contains seven chapters which deal with the history of depreciation accounting, interpretations of depreciation, a critique of various theories, the nature of depreciation, the causes of depreciation, and an exposition of the methods of accounting for depreciation. Santiago Estrada is a public accountant and an Honorary Professor of Accounting in the Faculty of Economic Science at Universidad Nacional de Cuyo in Argentina.

MICHAEL FIRTH and SIMON M. KEANE, Editors, *Issues in Finance* (Oxford: Philip Allan Publishers Limited; distributed in the U.S.A. and Canada by Humanities Press, Atlantic Highlands, New Jersey, 1986, pp. x, 269, $22.50 paper, $60.00 cloth).

Nineteen chapters cover major underlying theories of finance, aspects of corporate financial management when firms are faced with financing and investment decisions, the valuation of companies and their securities, international finance, implications of recent empirical research, and the current state of the discipline. Twelve of the contributors are identified with the field of accounting. Michael Firth is Professor of Accountancy at the University of Colorado at Denver and Simon Keane is Professor in Business Finance, University of Glasgow.

S. J. GASTON, *Controlling and Auditing Small Computer Systems* (Toronto: The Canadian Institute of Chartered Accountants, 1986, pp. xxi, 236, Can. $34.50).

Study is one of a series of Research Studies which are part of the CICA's continuing research program. Twelve chapters cover various topics concerned with controlling and auditing small computer systems. Purpose is to provide practical advice to managers of small computer systems and to accountants advising clients on such systems and auditing statements produced by such systems. S. J. Gaston, FCA, is at Price Waterhouse.

PAUL E. GLICK, *How to Understand Local Government Financial Statements: A User's Guide*, Financial Reporting Series, Volume 6 (Chicago: Government Finance Officers Association of the United States and Canada, 1986, pp. xi, 55, $7.50 paper).

Four chapters explain basic governmental accounting concepts on the reporting entity, annual reports, and financial statements to those persons with little expertise in this area. Paul Glick is Assistant Director of Government Finance Officers Association Technical Services Center.

PAUL E. GLICK, *Illustrations of Combined, Combining and Individual Fund and Account Group Financial Statements of State and Local Governments*, Financial Reporting Series, Volume 7 (Chicago: Government Finance Officers Association of the United States and Canada, 1985, pp. xii, 473, $27.50 paper members, $35.00 paper nonmembers, $22.00 paper students).

Presents examples selected from over 800 reports on how governments have prepared the various components of financial reports. These component parts include the auditors' report, general purpose financial statements, combining and individual fund financial statements, and account group presentation. Paul Glick is Assistant Director of Government Finance Officers Association Technical Services Center.

R. H. GRAY, Editor, *The British Accounting Association Research Register 1986* (The British Accounting Association in association with The Institute of Chartered Accountants in England and Wales, 1986, pp. vii, 344, £20 nonmembers, free for members).

Second edition of the biennial research register of the British Accounting Association. Includes teaching specialties, research interests, and 1984–85 publications of 833 academic staff members in accounting and finance from 89 universities, polytechnics, and colleges throughout the British Isles. Departmental entries include staff changes and other information such as address and telephone number. The editor is at the Department of Economics, University College of North Wales, Bangor, Gwynedd LL57 2DG, U.K.

WILMER L. GREEN, *History and Survey of Accountancy*, Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1930] 1986, pp. 288, $45.00).

Reprint of the text published in 1930. Eight chapters cover the world history of accounting and bookkeeping, U.S. and foreign legislation, education for the accountancy profession, U.S. and other countries' accountants' societies, ethics, and a synopsis of U.S. state requirements for C.P.A. certificates. At the time of original publication, Wilmer Green was Associate Professor of Law and History of Accountancy at St. John's College School of Accounting, Commerce and Finance.

ROBERT K. JAEDICKE, YUJI IJIRI, and OSWALD NIELSEN, Editors, *Research in Accounting Measurement*, Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1965] 1986, pp. xii, 267, $40.00).

Reprint of a 1965 publication of papers given at the Seminar on Basic Research in Accounting Measurement, organized by the accounting faculty of Stanford University Graduate School of Business. General topics include measurement in financial accounting, reliability in accounting measurements, the behavioral implications of accounting measurements, and the impact of accounting measurements on the firm's external environment. At the time of original publication, Robert Jaedicke and Yuji Ijiri were Associate Professors and Oswald Nielsen was Professor at Stanford University.

ANDREA S. KRAMER, *Taxation of Securities, Commodities, and Options* (New York; Chichester, England; Brisbane; Toronto and Singapore: A Ronald Press Publication, John Wiley & Sons, 1986, pp. liii, 896, $85.00).

First part contains an overview of the securities, commodities, and options markets and remaining ten parts cover taxation of various participants and different types of transactions. Tables of Internal Revenue Code sections, Treasury pronouncements, and legislative history are provided. A free supplement addressing the 1986 tax legislation's effect on transactions in securities, commodities, and options will be sent to all subscribers. Andrea Kramer is a partner in the Chicago law firm of Coffield Ungaretti Harris & Slavin.

KALLE LYYTINEN, *Information Systems Development As Social Action: Framework and Critical Implications,* Jyväskylä Studies in Computer Science, Economics and Statistics 8 (Jyväskylä, Finland: University of Jyväskylä, 1986, pp. iii, 337).

Eight chapters cover the evaluation of information systems, remedies against defects and failures of these systems, information systems development, critical social theory, and technical and practical cognitive interest and information systems development. Includes a summary in Finnish. Kalle Lyytinen's thesis is the result of research work performed during the academic years 1982–1985 as a visiting researcher at the University of Stockholm, and as a researcher at the Department of Computer Science, University of Jyväskylä.

J. L. MEIJ, Editor, *Depreciation and Replacement Policy,* Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1961] 1986, pp. xii, 235, $40.00).

Reprint of the 1961 volume which presented the studies and research of seven contributors from four countries. Four studies cover depreciation and obsolescence as factors in costing, depreciation, and the maintenance of real capital; depreciation problems and taxation; and the theory of depreciation and entrepreneurial behavior. At the time of original publication, the editor was Professor of Industrial Economics, State University of Groningen, The Netherlands.

BELVERD E. NEEDLES, JR., Editor, *The Accounting Profession and the Middle Market,* DePaul University Research Symposium, 1985–86 (Chicago: DePaul University, College of Commerce, School of Accountancy, 1985, pp. vi, 181, $10.00 paper).

Presents the proceedings of the second biennial research symposium of the School of Accountancy of DePaul University. The seven papers for the symposium fall into three groups: the financial issues related to the middle market, the control issues of smaller businesses, and the marketing issues of offering new services to middle-market clients. Each paper is presented and followed by comments from academic and practitioner discussants. Belverd E. Needles, Jr. is Director of DePaul University's School of Accountancy.

ROGER NORTH, *The Gentleman Accomptant,* Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1714] 1986, pp. vi, 263, $45.00).

Reprint of the 1714 text with the complete title of *The Gentleman Accomptant; Or, An Essay to Unfold the Mystery of Accompts; By Way of Debtor and Creditor, Commonly Called Merchants Accompts, and Applying the Same to the Concerns of the Nobility and Gentry of England.* Includes a list of accounting terms used at the time.

ROBERT SHAPLEN, *Kreuger: Genius and Swindler,* Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1960] 1986, pp. xiv, 251, $40.00).

Reprint of the 1960 biography of Ivar Kreuger, a financial swindler and forger whose rise and fall spanned the years of boom and depression between 1922 and 1932. The introduction is by John Kenneth Galbraith. At the time of the original publication, Robert Shaplen was a writer and a regular contributor to *The New Yorker* and other magazines.

WILLIAM J. VATTER, *Managerial Accounting,* Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1950] 1986, pp. vii, 510, $75.00).

Reprint of text published in 1950. Five parts cover accounting concepts, budgeting and managerial control, elements of accounting systems, accounting for unit product cost, and problems of cost interpretation. At the time of original publication, William Vatter was Professor of Accounting at the University of Chicago.

Gerald M. Ward and Jonathan D. Harris, *Managing Computer Risk: A Guide for the Policymaker*, The Wiley/Ronald-National Association of Accountants Professional Book Series (New York; Chichester, England; Brisbane; Toronto and Singapore: A Ronald Press Publication, John Wiley & Sons, 1986, pp. xiv, 182, $32.95).

First part of book deals with management-level strategic and implementation issues and the second part addresses technical concepts and products that need to be understood by the policymaker. Includes a glossary of technical jargon associated with computers and a 1986 survey of organizational representatives covering the use, management, and control of microcomputers. Gerald Ward is an audit partner and Jonathan Harris is a management consulting services partner of Price Waterhouse.

C. A. Westwick, *Accounting for Overseas Operations* (Aldershot, England; Brookfield, Vermont: Gower Publishing Company, 1986, pp. ix, 184, $58.50).

Provides a guide to SSAP 20, "Foreign Currency Translation." Includes a critique of accepted methods of accounting for overseas operations; the requirements for disclosure in published accounts in the U.K. and U.S.; and distributions of profit arising from overseas transactions, investments, and loans by a U.K. company. Also outlines the U.K. Revenue's taxation of profits from overseas business, investment, and borrowing. C. A. Westwick is a Chartered Accountant at Arthur Andersen & Co.

Arthur H. Woolf, *A Short History of Accountants and Accountancy*, Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1912] 1986, pp. xxxi, 254, $40.00).

Reprint of the 1912 publication which included a series of articles written for *The Accountant*. Four parts cover development of systems of accounting, growth of the science of bookkeeping, origin and progress of auditing, and rise and progress of professional accountants. Includes a list of works consulted which date between 1769 and 1912. At the time of original publication, Arthur Woolf, M.A. (Lond.), was Of the Inner Temple, Barrister-at-Law.

Editor's Note: Julianne Rappa assisted the editor in annotating these books.

Books Received From July 10, 1986 to November 8, 1986

Akron Business and Economic Review, Volume 17, No. 3, Fall 1986 (Akron, Ohio: College of Business Administration, The University of Akron, 1986, pp. 120, $6.00 annual subscription).

Jerry L. Arnold and William W. Holder, *Impact of Statement 52 on Decisions, Financial Reports and Attitudes* (Morristown, New Jersey: Financial Executives Research Foundation, 1986, pp. viii, 156, $12.00 paper).

W. T. Baxter, *Inflation Accounting* (Oxford: Philip Allan Publishers Limited; distributed in the U.S.A. and Canada by Humanities Press, Atlantic Highlands, New Jersey, 1984, pp. viii, 296, $21.00 paper, $42.00 cloth).

Phillip W. Bell, *Current Cost/Constant Dollar Accounting and Its Uses in the Managerial Decision-Making Process*, with a Preface by Geoffrey Whittington. McQueen Accounting Monograph Series, Volume No. 3 (Fayetteville, Arkansas: University of Arkansas, 1986, pp. xvi, 73, $7.00 paper).

Herman W. Bevis, *Corporate Financial Reporting in a Competitive Economy*, Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1965] 1986, pp. ix, 212, $35.00).

Charles P. Bonini, Robert K. Jaedicke and Harvey M. Wagner, Editors, *Management Controls: New Directions in Basic Research*, Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1963] 1986, pp. xviii, 341, $55.00).

Richard P. Brief, Editor, *Corporate Financial*

Reporting and Analysis in the Early 1900s, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., 1986, pp. 234, $24.00).

RICHARD P. BRIEF, Editor, *Estimating the Economic Rate of Return from Accounting Data,* Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., 1986, pp. 201, $22.00).

LEONARD J. BROOKS, JR., *Canadian Corporate Social Performance* (Hamilton, Ontario: The Society of Management Accountants of Canada, 1986, pp. xii, 267, Can. $15.00 nonmembers, Can. $11.25 paper members).

PHILIP BROWN, Editor, *1986 Directory of Accounting Academics-Australia and New Zealand* (Nedlands, Western Australia: The University of Western Australia, 1986, pp. 163).

JOHN E. BUTTERWORTH and HAIM FALK, *Financial Reporting—Theory and Application to the Oil and Gas Industry in Canada* (Hamilton, Ontario: The Society of Management Accountants of Canada, 1986, pp. viii, 250, Can. $15.00 paper nonmembers, Can. $11.75 paper members).

JOHN L. CAREY and WILLIAM O. DOHERTY, Editors, *Ethical Standards of the Accounting Profession,* Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1966] 1986, pp. x, 330, $55.00).

R. J. CHAMBERS and G. W. DEAN, Editors, *Chambers On Accounting,* Accounting Thought and Practice Through the Years series, Volume I: Accounting, Management and Finance, pp. 346, $35.00; Volume II: Accounting Practice and Education, pp. 384, $35.00; Volume III: Accounting Theory and Research, pp. 496, $55.00; Volume IV: Price Variation Accounting, pp. 333, $35.00; Volume V: Continuously Contemporary Accounting, pp. 507, $50.00 (New York and London: Garland Publishing, Inc., 1986).

Computer Control Guidelines, Second Edition (Toronto: The Canadian Institute of Chartered Accountants, 1986, pp. 197, Can. $32.50 paper).

ALLEN CRASWELL, *Audit Qualifications in Australia 1950 to 1979,* Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., 1986, pp. x, 169, $22.00).

SANTIAGO N. ESTRADA, *La Amortizacion de los Activos Fijos en la Teoria Contable* (Mendoza, Argentina: Inca Editorial, 1985, pp. 130).

MICHAEL FIRTH and SIMON M. KEANE, Editors, *Issues in Finance* (Oxford: Philip Allan Publishers Limited; distributed in the U.S.A. and Canada by Humanities Press, Atlantic Highlands, New Jersey, 1986, pp. x, 269, $22.50 paper, $60.00 cloth).

S. J. GASTON, *Controlling and Auditing Small Computer Systems* (Toronto: The Canadian Institute of Chartered Accountants, 1986, pp. xxi, 236, Can. $34.50).

PAUL E. GLICK, *How to Understand Local Government Financial Statements: A User's Guide,* Financial Reporting Series, Volume 6 (Chicago: Government Finance Officers Association of the United States and Canada, 1986, pp. xi, 55, $7.50 paper).

PAUL E. GLICK, *Illustrations of Combined, Combining and Individual Fund and Account Group Financial Statements of State and Local Governments,* Financial Reporting Series, Volume 7 (Chicago: Government Finance Officers Association of the United States and Canada, 1985, pp. xii, 473, $27.50 members, $35.00 nonmembers, $22.00 students).

R. H. GRAY, Editor, *The British Accounting Association Research Register 1986* (The British Accounting Association in association with The Institute of Chartered Accountants in England and Wales, 1986, pp. vii, 344, £20 nonmembers, free for members).

LORETTA GRAZIANO, *Currency Fluctuations and the Perception of Corporate Performance* (New York; Westport, Connecticut and London, 1986, pp. viii, 183, $35.00).

WILMER L. GREEN, *History and Survey of Accountancy,* Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1930] 1986, pp. 288, $45.00).

DAVID HALBERSTAM, *The Reckoning* (New York: William Morrow and Company, Inc., 1986, pp. 752, $19.95).

J. PHILIP HARDMAN and PAUL ESSEX, "A Practical Guide to Social Security Contributions 1986/87," *Accountants Digest 188,* Summer 1986 (London: The Institute of Chartered Accountants in England and Wales, 1986, pp. 56, £6 paper).

The International Trade Journal, Volume I, No. 1, Fall 1986 (Laredo, Texas: Institute of International Trade, Laredo State University, 1986, pp. 108, $10.00 single copy, $25.00 annual subscription).

ROBERT K. JAEDICKE, YUJI IJIRI and OSWALD NIELSEN, Editors, *Research in Accounting Measurement,* Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc.,

[1965] 1986, pp. xii, 267, $40.00).

Haydn Jones, *Accounting, Costing and Cost Estimation* (Cardiff, Wales: University of Wales Press; distributed in the U.S.A. and Canada by Humanities Press, Atlantic Highlands, New Jersey, 1985, pp. ix, 285, $45.00).

James R. Jorgensen, *Business Income Insurance —How It Works* (San Antonio, Texas: B J Publications, 1986, pp. ii, 78, $9.95 paper).

Journal of Accounting and EDP, Volume 2, No. 2, Summer 1986 (Boston: Auerbach Publishers, Inc., 1986, pp. 72, $64.00 annual subscription).

John W. Kendrick, *Improving Company Productivity* (Baltimore, Maryland: The Johns Hopkins University Press, 1986, pp. xii, 220, $10.95 paper, $24.50 cloth).

Andrea S. Kramer, *Taxation of Securities, Commodities, and Options* (New York; Chichester, England; Brisbane; Toronto and Singapore: A Ronald Press Publication, John Wiley & Sons, 1986, pp. liii, 896, $85.00).

Paul J. Lochray, *The Financial Planner's Guide to Estate Planning* (Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1987, pp. xi, 283, $29.95).

Kalle Lyytinen, *Information Systems Development as Social Action: Framework and Critical Implications*, Jyväskylä Studies in Computer Science, Economics and Statistics 8 (Jyväskylä, Finland: University of Jyväskylä, 1986, pp. iii, 337).

Jill L. McKinnon, *The Historical Development and Operational Form of Corporate Reporting Regulation in Japan*, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., 1986, pp. ii, 453, $50.00).

J. L. Meij, Editor, *Depreciation and Replacement Policy*, Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1961] 1986, pp. xii, 235, $40.00).

Belverd E. Needles, Jr., Editor, *The Accounting Profession and the Middle Market*, DePaul University Research Symposium, 1985–86 (Chicago: DePaul University, College of Commerce, School of Accountancy, 1985, pp. vi, 181, $10.00 paper).

Grant W. Newton and Gilbert D. Bloom, *Tax Planning for the Troubled Business—1986* (New York; Chichester, England; Brisbane; Toronto and Singapore: A Ronald Press Publication, John Wiley & Sons, 1986, pp. xv, 372, $49.95).

Roger North, *The Gentleman Accomptant*, Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1714] 1986, pp. vi, 263, $45.00).

Lee D. Parker, *Developing Control Concepts in the 20th Century*, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., 1986, pp. ix, 324, $30.00).

R. H. Parker, G. C. Harcourt and G. Whittington, Editors, *Readings in the Concept and Measurement of Income*, Second Edition (Oxford: Philip Allan Publishers Limited; distributed in the U.S.A. and Canada by Humanities Press, Atlantic Highlands, New Jersey, 1986, pp. vi, 371, $55.00).

Chris Robinson and Len Fertuck, *Materiality: An Empirical Study of Actual Auditor Decisions*, Research Monograph No. 12 (Vancouver, British Columbia: The Canadian Certified General Accountants' Research Foundation, 1985, pp. ix, 61, Can. $11.50 paper).

Robert Shaplen, *Kreuger: Genius and Swindler*, Reprint, Accounting Thought and Practice Through the Years series (New York and London: Garland Publishing, Inc., [1960] 1986, pp. xiv, 251, $40.00).

Michael T. Skully, *American Depositary Receipts: Internationalizing Australian Fund Raising and Securities Trading*, CEDA Information Paper (Melbourne: Committee for Economic Development of Australia, 1986, pp. 44, Aus. $10.00 paper).

David Solomons, *Making Accounting Policy*, The Wharton Executive Library series (New York: Oxford University Press, 1986, pp. ix, 261, $17.95).

Mark Stevens, *The Accounting Wars* (New York: Macmillan Publishing Company, 1985, pp. x, 261, $7.95 paper).

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APRIL 1987 PLACEMENT ADS

The deadline for information to be included in the "Placement Information" section is two months prior to the date of publication. The Review is published on the first day of January, April, July, and October. Placement advertising and replies should be sent to the American Accounting Association, 5717 Bessie Drive, Sarasota, FL 33583. All replies to box numbers should be on separate sheets to facilitate forwarding. There is no charge for this service to AAA members and associate members seeking employment. Others will be charged a fee of $100 per insertion. Ads should not exceed 100 words.

#201 UNIVERSITY OF MISSOURI-ST. LOUIS has tenure-track positions; rank and salary dependent on qualifications. Most interest areas can be accommodated though candidates in cost/managerial, financial, governmental, international or systems preferred. Quality research and teaching expected. Candidates should possess a Ph.D./DBA. Professional certification desirable. ABDs considered for junior position. Senior appointment requires strong publication record. UMSL enrolls over 3,000 students in AACSB-accredited undergraduate and masters business programs. Pleasant suburban location. Submit resumé or inquiries to David R. Ganz, Coordinator, Accounting Area, University of Missouri-St. Louis, 8001 Natural Bridge Road, St. Louis, Missouri 63121-4499 (an affirmative action, equal opportunity institution).

#202 THE UNIVERSITY OF MARYLAND European and Asian Divisions seek excellent teachers for undergraduate courses on U.S. military bases overseas. Minimum requirements include a master's in accounting, one year of recent college teaching experience, and U.S. citizenship. Renewable annual appointments begin August 1987. Excellent for a sabbatical or leave of absence. Benefits include transportation and military base privileges. Frequent travel and the cost of schooling make these positions difficult for those with children. Send resumé to Dr. Lois A. Mohr, The University of Maryland University College, College Park, MD 20742-1642. AA/EEO

#203 GEORGIA COLLEGE invites applications for a full-time tenure-track position. Candidates should have a doctorate in accounting (ABD will be considered). Teaching responsibilities include undergraduate and MBA accounting courses. Salary and rank commensurate with qualifications and experience. Georgia College with approximately 4,000 students is 30 miles northeast of Macon and 95 miles southeast of Atlanta. The college is an equal opportunity, affirmative action employer. Send letter of application, vita, official transcripts, and the names, addresses and telephone numbers of three references to: Mr. Don Rouk, Chairman, Accounting Search Committee, School of Business, CPO 015, Milledgeville, GA 31061.

#204 FACULTE DES SCIENCES DE L'ADMINISTRATION, UNIVERSITE LAVAL. La Faculté des sciences de l'administration de l'Université Laval invite les personnes intéressées à enseigner au niveau des trois cycles universitaires et à faire de la recherche, à soumettre leur candidature. Cet enseignement et cette recherche pourraient être reliés a l'une des disciplines suivantes: Comptabilité. Finance et assurance, Management, Marketing, Systémes d'information organisationnels, Economie appliquée à la gestion, Systémes de décision et de la Gestion des opérations. Nous offrons des postes aux rangs d'adjoint, d'agrégé ou de titulaire. Les personnes intéressées doivent détenir un doctorat ou être sur le point de l'obtenir. Les conditions d'emploi sont régies par la convention collective en vigueur. Les dates d'entrée en fonction *sont à partir du ler juin 1987.* S'il vous plaît, faire parvenir votre curriculum vitae à: Monsieur Jean-Marc Martel, Vice-doyen aux affaires professorales, Faculté des sciences de l'administration, Université Laval, Québec G1K 7P4, Canada.

#205 MANHATTAN COLLEGE SCHOOL OF BUSINESS. Faculty openings in Accounting. Medium-sized, independent, private college seeks part-time and full time faculty in Accounting to teach in both undergraduate and graduate programs. Ph.D/D.B.A., teaching experience, publications for upper ranks; MBA/CPA considered for lower ranks. Salary competitive in categories 1 + of AAUP ratings. Attractive fringe benefits. Send resumé to: Dr. Faraj Abdulahad, Dean, School of Business, Manhattan College, Riverdale, New York 10471. An AA/EO Employer.

#206 CALIFORNIA STATE UNIVERSITY, LOS ANGELES is accepting applications from candidates for Assistant, Associate and Full Professor positions for 1986-87. Tenure-track and one-year appointments are available. Tenure-track positions normally require a doctorate or ABD, except in taxation which requires a J.D. or MBT. Candidates should be able to demonstrate teaching effectiveness and research capabilities. The Department's strongest needs are for persons who can teach financial accounting (undergraduate and graduate). California State University, Los Angeles is an Equal Opportunity/Affirmative Action Employer. Interested candidates are invited to submit their curriculum vitae to Gary V. Jorden, Chair, Department of Accounting, California State University, Los Angeles, CA 90032.

#207 SUFFOLK UNIVERSITY, Boston, Massachusetts. The Accounting Department of the School of Management is seeking faculty members to fill tenure-track positions. Teaching will be at the undergraduate/graduate level(s). Primary openings in governmental fund accounting, managerial or financial areas. Qualified candidates should be able to teach in a second accounting area. Evidence of effective teaching, research competence and a strong record of publications required. PhD/DBA in Accounting required. CPA, CMA, or other certification(s) desirable. Apply to Ronald Sundberg, Associate Dean, School of Mangement, Suffolk University, Beacon Hill, Boston, MA 02108 or call (617) 723-4700, ext. 307. An equal opportunity, affirmative action employer.

#208 ALL POSITIONS, tenure-track, for the 1987-88 year. Minimum qualifications: Ph.D. or DBA in Accounting (ABD considered if dissertation in process). Undergraduate and graduate level teaching. Salary is competitive. Send resumé to: Teddy L. Coe, Department of Accounting, North Texas State University, Denton, Texas 76203. NTSU is an Equal Opportunity, Affirmative Action Employer.

#209 UNIVERSITY OF OTTAWA—The FACULTY OF ADMINISTRATION invites applications for Assistant-Professors in Accounting for July 1st, 1987. Tenure-track appointments require Ph.D. in hand or near completion. Applicants should have a strong commitment to teaching and must be able to demonstrate an ability to undertake research activities. Undergraduate and/or graduate teaching. Salary open to negotiation, commensurate with experience and qualifications. In accordance with Canadian Employment and Immigration requirements, priority will be given to Canadian citizens and permanent residents of Canada. Send resumés and three references to: Gilles Paquet, Dean, Faculty of Administration, University of Ottawa, 275 Nicholas Street, Ottawa, Ontario, K1N 6N5, Canada.

#210 BAR ILAN UNIVERSITY, RAMAT GAN, ISRAEL 52100. Two openings are available for junior and moderately senior Accountants. Candidates should have a Doctorate in Accounting or ABD with substantial progress toward completion from U.S. or British Departments of Accounting or similar departments in other countries. All candidates are expected to immigrate to Israel. The teaching language is Hebrew and candidates should undertake to be able to lecture in Hebrew within 2 years. Send curriculum vitae and 2 letters of reference. Contact: Chairman-Department of Economics and Business Administration, Bar Ilan University, Ramat Gan, Israel 52100.

#211 UNIVERSITY OF VIRGINIA, DARDEN GRADUATE SCHOOL OF BUSINESS, invites applications from qualified individuals with teaching and research interests in financial or managerial accounting at the graduate level. Rank open. Demonstrated ability or potential for effective teaching and quality research are essential. Send resumé and publications to: Charles Meiburg, Associate Dean, Darden Graduate School of Business, Box 6550, Charlottesville, VA 22906. The University of Virginia is an affirmative action/equal opportunity employer.

#212 LECTURER, ASSISTANT OR ASSOCIATE PROFESSOR; auditing is our primary need, but others will be considered. Assistant and Associate positions require a doctorate in accounting from an AACSB accredited school; Associate requires a record of teaching excellence and a record of recent and continuing research published in national refereed journals. ABD within one year of completion will be considered. Masters/CPA can be appointed to non-tenure track lecturer positions. Send resumé to: Chair, Department of Accounting, College of Business and Economics, University of Nevada, Las Vegas, Las Vegas, Nevada, 89154. Review of applications will begin on January 1, 1987. EO/AA employer.

#213 CHAIRPERSON, Department of Accounting, University of Nevada, Las Vegas. There are 14 faculty, 600 undergraduate majors; MS and MBA Programs. Applicants must have an earned doctorate in accounting from an AACSB accredited school and a record of recent and continuing research appearing in national publications. Send resumé, letter of application and three letters of reference to: Chair, Chairperson Search Committee, Department of Accounting, College of Business and Economics, University of Nevada, Las Vegas, Las Vegas, Nevada, 89154. Review of applications will begin on January 1, 1987 and continue until the position is filled. EO/AA employer.

#214 SAM HOUSTON STATE UNIVERSITY has tenure-track position available for Fall, 1987. Teach undergraduate and masters level accounting courses. Prefer Ph.D. or D.B.A. with CPA or CMA. Interest in research and publication desired. Individuals with interest in tax, auditing, or accounting information systems urged to reply. Public university with 500 accounting majors located in growing community 70 miles north of Houston, Texas. Send resumé to Dr. Thomas Rowe, Department of Accounting, Sam Houston State University, Huntsville, Texas, 77341. Equal Opportunity/Affirmative Action Institution.

#215 ASSISTANT PROFESSOR—TENURE TRACK. The University of Southern Maine seeks Ph.D. or D.B.A. to teach introductory financial accounting and intermediate or auditing or accounting information systems. Teaching experience and practical accounting experience is required; CPA desirable. Teaching effectiveness is emphasized; publication expected. Send resumé, graduate school transcript and references to: D. B. Hodson, Chair, Department of Accounting, University of Southern Maine, 96 Falmouth Street, Portland, Maine 04103. USM is an EEO/AA employer.

#216 ENDOWED CHAIR IN HEALTH MANAGEMENT. The Division of Health Services Administration, School of Public Health, seeks a distinguished researcher and teacher for a tenured chair professorship in *health services management*. Relevant scholarly disciplines include strategy management, finance, accounting, insurance, operations research, organizational behavior, or decision sciences. *Qualifications*: Doctorate, 10 years research and teaching experience, nationally recognized intellectual leadership. *Application deadline*: May 1, 1987. Send complete resumé to John Kralewski, Chairman, Search Committee HJ-2, University of Minnesota, Mayo Box 97, Minneapolis, MN 55455, The University of Minnesota is an equal opportunity educator and employer and specifically invites and encourages applications from women and minorities.

#217 ASSOCIATE/ASSISTANT PROFESSOR OF ACCOUNTING. Two tenure-track positions available August 1987. Teaching various undergraduate and master level courses. Some research required. Prefer terminal degree in field, but ABD's near completion will be considered. Salary is competitive. Excellent living conditions in small city setting. Send resumé, transcripts, and three letters of reference to Professor W. J. Radig, Acting Chairman, Department of Accounting, Marshall University, Huntington, West Virginia 25701. Application deadline is: May 15, 1987 or until positions are filled. Marshall University is an Equal Opportunity/Affirmative Action Employer.

#218 THE UNIVERSITY OF MANITOBA is seeking applicants for tenure-track positions in accounting for July 1987. Rank is open, based on qualifications and experience. A visiting appointment is also possible. Ph.D. or DBA, completed or near completion is required. Duties include research and teaching at the undergraduate and graduate levels. Salary is competitive and will depend on qualifications, experience and research record. Winnipeg, a multicultural city of 600,000, offers the best of an urban environment in the heart of Canada's vacation land. Both women and men are encouraged to apply. In accordance with Canadian immigration requirements, priority will be given to qualified Canadian citizens and permanent residents of Canada. Applications should be sent to: DR. L. I. GOULD, HEAD, DEPARTMENT OF ACCOUNTING AND FINANCE, UNIVERSITY OF MANITOBA, WINNIPEG, MANITOBA, R3T 2N2.

#219 RHODES COLLEGE invites applications for a tenure track position beginning August 1988. The doctorate is required, and applications must show evidence or promise of excellence in both teaching and research. Rhodes College is a selective, private, coeducational college of the liberal arts and sciences with a student-faculty ratio of 12 to 1 and a very successful accounting program. The teaching load is 9 hours per semester. The salary is competitive and generous research grants and travel funds are available. Send resumé and 3 letters to Dr. Marshall E. McMahon, Rhodes College, Memphis, TN 38112. Affirmative Action/Equal Opportunity Employer.

#220 ROCHESTER INSTITUTE OF TECHNOLOGY invites applications for Assistant/Associate Professor of Accounting. Assistant candidates should have an appropriate doctorate or be near completion, Associate strong teaching and publication records. Salary competitive, fringes excellent. RIT is a private university of approximately 14,000 in a city offering a full range of educational, cultural, and social activities and a high technology industrial base. The College has approximately 1900 undergraduates and graduates and 46 faculty. RIT encourages excellence in teaching, research, and professional activity. Send applications to: Professor Bruce L. Oliver, Department of Accounting, College of Business, Rochester Institute of Technology, Rochester, NY 14623. An equal opportunity, affirmative action employer.

#221 D.B.A., CPA, CMA. Excellent classroom reputation. Many teaching awards. Numerous recent publications. Specialty area is auditing. Seeking full professorship at a high-quality institution. Am presently an associate professor at a doctoral-granting university and editor of a professional accounting journal. Current salary is mid-sixties over twelve months.

#222 WASHINGTON AND JEFFERSON COLLEGE invites applications for a new tenure-track faculty position which will become available September, 1987. Twelve hour undergraduate teaching load in the areas of managerial, cost, and corporate tax accounting. Teaching experience and knowledge of computer applications desirable. Minimum requirement: MBA or MS in Accounting, and CPA or CMA. Send resumé to Dr. Felix R. Livingston, Chairman, Department of Economics and Business, Washington and Jefferson College, Washington, PA 15301.

#223 YORK UNIVERSITY, TORONTO, CANADA seeks accounting faculty. Rank is dependent upon qualifications; salary and benefits are competitive. Candidates must possess a doctorate or be close to completion. Both effective teaching and quality publications will be expected. York University is Canada's third largest university, and the Faculty of Administrative Studies contains the country's largest and most diverse MBA program. Other programs are a small honors BBA program and a Ph.D. program. In accordance with Canadian immigration requirements, preference will be given to Canadian citizens and permanent residents. York University is an equal opportunity employer. Contact Dr. L. S. Rosen, Faculty of Administrative Studies, York University, North York, Ontario, Canada, M3J 1P3.

#224 VALPARAISO UNIVERSITY, College of Business Administration, seeks candidates for two permanent positions in Accounting. Rank open—Assistant, Associate or Professor. Requires Doctorate or ABD, with commitment to teaching, research and service. CPA/CMA desirable. VU is a top-quality, church related university with 600 business undergraduates. Beautiful campus in pleasant community one hour's drive from Chicago Loop, 15 minutes from Lake Michigan dunes and beach. Send resumé to Dr. John Miller, Dean, College of Business Administration, Valparaiso University, Valparaiso, IN 46383. An Affirmative Action/Equal Opportunity Employer.

#225 LOYOLA COLLEGE IN MARYLAND invites applications for tenure-track accounting positions in managerial, international, financial and tax at all ranks for September 1987. The College is actively pursuing AACSB accreditation. Faculty teach in undergraduate, MBA, and Executive MBA programs. There is a nine-person department and 90 senior majors. Research and publications are required and supported. Applicants must possess doctorate or equivalent; however, candidates nearing completion of dissertation will be considered. Reply to: John P. Guercio, Chairman, Department of Accounting, Loyola College, 4501 N. Charles Street, Baltimore, MD 21210. EEO/AAE.

#226 TEXAS A & I UNIVERSITY, Department of Accounting invites applications for a tenure track appointment in the area of advanced financial accounting for the Fall 1987 term. A Doctorate in Accounting is required with a record of teaching experience and publication for appointment at higher ranks. Salary $40,000+ and dependent on rank. Texas A & I University is located in South Texas approximately 40 miles south of Corpus Christi. The College of Business Administration has approximately 1,200 students and offers the BBA, MBA, MPA degrees. The University is an Equal Opportunity/Affirmative Action Employer. Interested persons should submit a resumé to: Dr. Robert Kirby, College of Business Administration, P.O. Box 182, Texas A & I University, Kingsville, Texas 78363.

#227 DIRECTOR-QUALITY CONTROL. If you are a CPA and have significant academic teaching experience in accounting and auditing, we have a unique professional opportunity for you. We are the largest independent accounting firm in Connecticut and are searching for a qualified individual to head our quality control area. You will report directly to the firm's Director of Accounting and Auditing. Your primary responsibilities will include our continuing education program in accounting and auditing, technical consultation and research, monitoring the firm's compliance with professional standards, firm policies and procedures, and maintaining accounting and auditing manuals. Qualified candidates for this unique and challenging position should forward their resumés in complete confidence to Conrad A. Kappel, CPA, Director of Accounting and Auditing, Blum, Shapiro & Company, 29 North Main Street, West Hartford, Ct., 06107.

#228 LA SALLE UNIVERSITY seeks applications for two tenure-track positions at the Assistant/Associate level. Ph.D. in accounting. ABD near completion also considered. Nine hour teaching load (two preparations) in MBA and undergraduate programs. We seek persons with balanced commitment to teaching excellence and research activity. Flexible teaching schedule. Strong institutional support for research. Informal environment. Accounting Department has 600 majors and 13 full-time faculty. La Salle is a 125-year-old private institution with about 6,000 students located in Philadelphia. Send resumé to: Joseph G. Markmann, Chairman, Accounting Department, La Salle University, Philadelphia, PA 19141. Equal Opportunity/Affirmative Action Employer.

#229 WASHBURN UNIVERSITY: Academic Program Accounting Administrator, preferably at Associate/Professor rank. Qualifications: AACSB-defined "appropriate doctoral degree" for teaching in accounting: Ph.D. or D.B.A. in accounting preferred; leadership potential for research; quality teaching and CPA strongly preferred. Responsibilities: Teach two courses per semester; half-time administration; maintain active research program; assist faculty in reaching level of research for undergraduate AACSB accreditation. Salary commensurate with qualifications/experience. Deadline May 1, 1987, or until suitable candidate identified. Available July 1–August 15, 1987. Contact Dean Richard Olson, School of Business, Washburn University, Topeka, KS 66621; (913) 295-6307. Equal Opportunity/Affirmative Action Employer.

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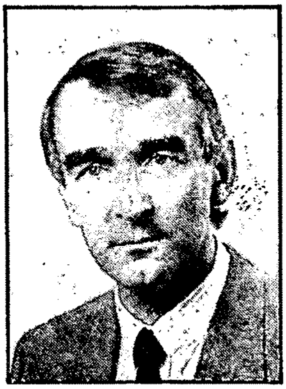

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The American Accounting Association is pleased to announce the selection of its 1987 Distinguished International Visiting Lecturers in Accounting. Adolf G. Coenenberg, Professor of Business Administration at the University of Augsburg, was selected as the Distinguished International Lecturer to visit schools in the United States and Canada in the fall of 1987. Professor Coenenberg will lecture at nine universities. They are the University of Texas at San Antonio, the University of Oklahoma, the University of Illinois at Urbana-Champaign, the University of Toronto, the University of South Carolina, Carnegie-Mellon University, the University of Pittsburgh, Texas Christian University, and Rutgers University. Gerhard G. Mueller, Professor of Accounting at the University of Washington, was selected as the professor from the United States or Canada to visit educational institutions in Africa during 1987.

The American Accounting Association is appreciative of the financial support this program receives from Ford Motor Company and Exxon Corporation. The annual Exxon controller's grant of $5,000 and a three-year $10,000 commitment of support from Ford Motor Company are used by the Association to provide financial support connected with this program.

Adolf Coenenberg has served as professor of business administration at the University of Augsburg, Federal Republic of Germany, since 1971. He is also a tax consultant. Born in Dusseldorf, he received his masters and doctorate degrees from the University of Cologne. In addition to serving as full professor at the University of Augsburg since 1971, Dr. Coenenberg has been a visiting professor at the University of Lancaster, England, Nagoya University of Finance and Commerce, Japan, and the University of Vienna, Austria.

In addition to being a member of the American Accounting Association, Adolf Coenenberg is a member of the Educational and Scientific Advisory Board of the University Post-Experience Business Institute, Erfstadt, Cologne, and of the Hernstein Management Institute in Vienna. He is also a member of the Main Technical Committee of the German Institute of CPAs and a member of the Executive Board of the German Society for Business Administration in Cologne. His main academic areas of interest are accounting and finance, capital budgeting, corporate valuation, and decision theory. He is the author or co-author of seven books and has made numerous contributions to academic journals and compendia, especially on the problems of business planning, decision theory, financial reporting, cost accounting, capital budgeting and corporate valuation. Professor Coenenberg also serves as joint editor of the academic journal "Die Betriebswirtschaft" (G. E. Poeschel Publishers, Stuttgart) and is a member of the International Editorial Advisory Board of the academic publication, *Journal of Business Finance and Accounting* (Oxford, England).

Professor Coenenberg will visit nine universities in the United States and Canada in September and October of 1987.

Gerhard G. Mueller will serve as the United States Distinguished International Visiting Lecturer who will visit universities in Zimbabwe, Ghana, Nigeria, and several other African countries in April and May of 1987. Gerhard Mueller is professor of accounting at the University of Washington and has been a member of the American Accounting Association since 1961. He has served on many Association committees, either as a member or chair, for the past fifteen years. In addition, he served as Vice-President on the Executive Committee in 1970–71.

Gerhard Mueller received the American Accounting Association's Outstanding Accounting Educator Award in 1982, the 1983 University of Washington Distinguished Teaching Award, the 1984 Distinguished Service Award from the University of Washington Department of Accounting, and was the recipient of the Washington Society of CPAs' Outstanding Educator Award in 1985. He is the author, co-author, or editor of twelve books. He was co-recipient of the AAA/DH&S Wildman Medal Award in 1986 for the book *International Accounting*.

Professor Mueller has given invited papers or addresses and participated in seminars in eleven countries outside of the United States and has served as a visiting professor at the University of Zurich (Switzerland) and the Cranfield School of Management (United Kingdom). He served as Chairman of the Department of Accounting at the University of Washington from 1969 to 1978 and as Director of the Graduate Professional Accounting Program from 1979 until the present.

Gerhard G. Mueller received his B.S. (Honors), M.B.A., and Ph.D. from the University of California at Berkeley.

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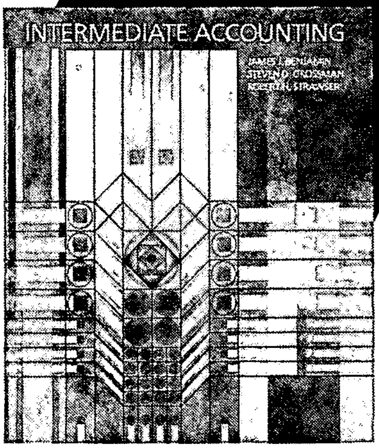

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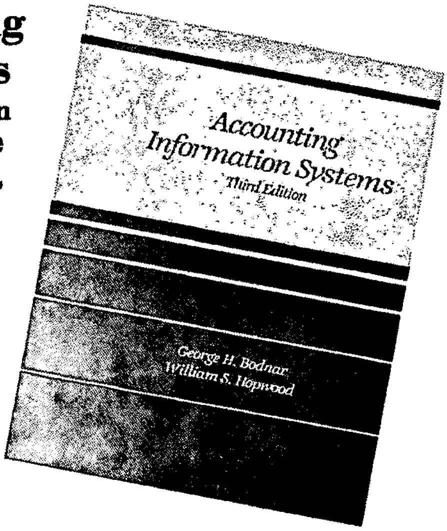

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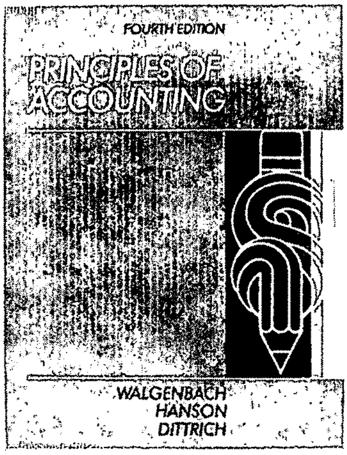

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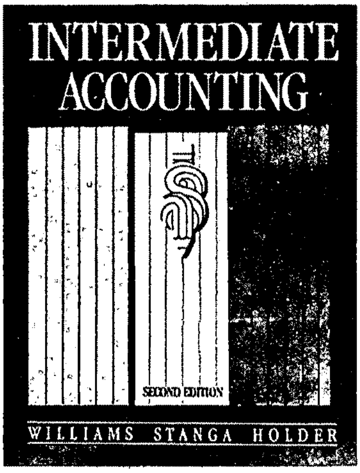

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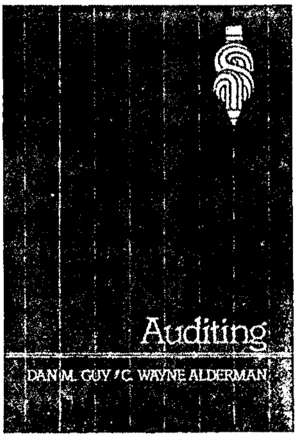

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